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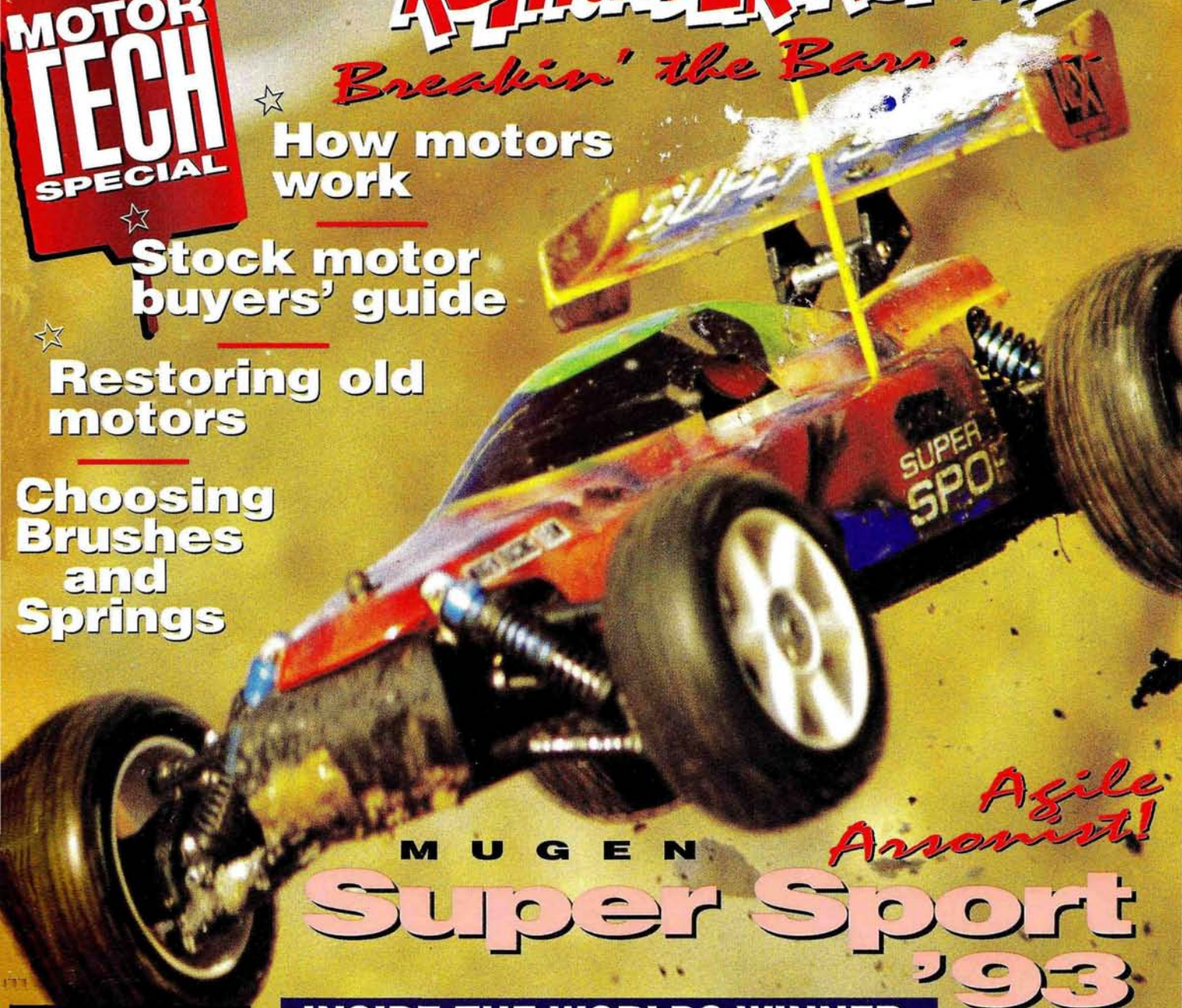


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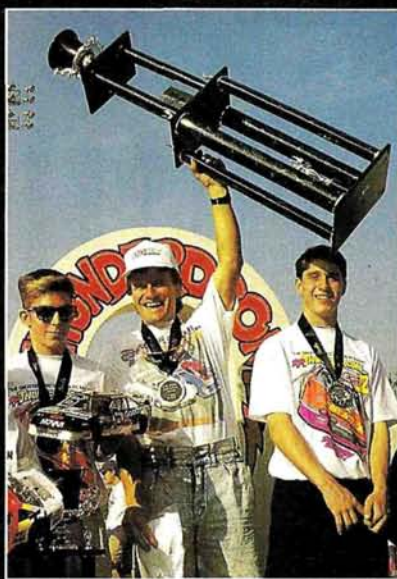
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STREET RACING

EDITORIAL

RACE COVERAGE: IS TOO LITTLE ENOUGH?

Why cover races?

Do race organizers or sanctioning bodies pay *Car Action* to fly its correspondents to their events? Are more copies of certain issues sold merely because they contain coverage of a certain race? No, on both counts.

To tell readers about hot drivers, we cover major races and provide them with the most up-to-date information about new products that factory teams often introduce at these events.

Contrary to popular opinion, the R/C car hobby involves more than just racing. In fact, a very small percentage of the racing car kits sold in this country are actually run on race tracks. Does this mean that R/C car racing holds little interest for the majority of hobbyists? No.

Regardless of whether they race their cars, most enthusiasts want the products that the big name racers use. You may think that it's a total waste



to use a top-of-the-line Associated Team Car to jump over milk crates, or to chase cats, but you should realize that although not everyone wants to race, they still want the latest, coolest hardware.

Some magazines become "wrapped around the axle" (one of the Ayatollah of Radio Controllah's favorite

sayings), which means that they spend too much time pondering negative aspects of the racing scene, as if racing is the be-all and the end-all of the R/C hobby. Hah!

Know who your audience is, and know how to address it. That's the key to a successful magazine. I realize that 99.9 percent of *Car Action* readers probably don't care who won a regional championship race or who came in ninth in the D-Main at the Nationals. I'm not trying to put down these accomplishments; I'm trying to make a point: as harsh as it may sound, the only people who really care about who finished where are those who attended the race. Should we take up magazine space to publicize smaller races just to satisfy their 50 or 150 entrants, even if we know that most readers will flip past the articles to look for something more appealing?

In part, I'm responding to the many requests we receive for race coverage. Yes, we'd love to cover every race and put everyone's name in print, but this is impossible. We try to cover as many major races as we can (and this doesn't even include all the many national races), because we feel that this information will benefit most of our readers.

Considering that each scale—1/12, 1/10, 1/8 and 1/4—has its own form of national championship (some scales have many national championships each year), you can see what a monumental task it is to cover these events.

Racing should accentuate the R/C car hobby, not define it. There are too many milk crates out there waiting to be jumped. ■

Frank R. Masi

Radio Control CAR ACTION

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NEWS

Prepare yourself for the ultimate in R/C off-road excitement and realism.

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Tired of 1/10-scale trucks and buggies that seem to get lost in the shortest grass? Swallowed up by the smallest of holes? Have you had it with suspensions that can only handle the tamest of jumps? Brace yourself for something completely different—MRC's new World Scale line.

Now, you may be asking yourself, "What's so different about World Scale? Haven't I seen this all before?" No. There's never been anything like World Scale—ever!

To begin with, the World Scale vehicles are *big*. Bigger than 1/10-scale; bigger even than some 1/8-scale vehicles. With up to 50 percent more mass than 1/10-scale vehicles, World Scale vehicles are big enough to run through the tallest grass without losing traction, and they can tackle jumps that would make smaller vehicles shake in their tires.

And durability. Let's just say that at the '92 Chicago RCHTA show, a Thunder King monster truck spent the entire weekend running headfirst into a cinderblock wall. At the end of the weekend, it was the wall that had given in—not the Thunder King!

Two other vehicles make up MRC's World Scale line: the Desert Thunder racing buggy and the Baja King stadium racing truck.

All World Scale vehicles feature a special, aircraft-grade aluminum-alloy chassis and MRC's Power Command tranny with a racing-type ball diff and slipper clutch. They also have not one but two powerful 540 motors, four oil-filled, aluminum-bodied shocks, and seven quality ball bearings inside the tranny for reliability and performance.

In addition, all three vehicles are fully track-tunable. Front toe-in/toe-out can be altered to suit track conditions, and front and rear camber are easily altered by adjusting the linkage. Three different shock pistons allow the World Scale vehicles to be "dialed-in" to any track, and MRC supplies two spur gears to permit the subtle gear-ratio changes that experienced drivers demand.

To find out more about World Scale, check out the complete line at your local hobby shop, or call (908) 248-0730 for tech information.

World Scale.

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LETTERS

WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Letters," *Radio Control Car Action*, 251 Danbury Rd., Wilton, CT 06897. Letters may be edited for clarity and brevity, and each must include a full name and address or telephone number so that the identity of the sender can be verified. We regret that, owing to the tremendous numbers of letters we receive, we can't respond to every one.

TRACKING DOWN ROAR

Your mag is the best one around. The "Pit Tips" column has really helped me with my RC10, Outlaw Rampage and Fox cars. But I need some information.

I'm stationed at Vandenberg Air Force Base in sunny California, but the closest R/C track is one hour away. A group of us R/C racers would like to build a track here on the base, but we have no plans to follow. Please tell me who to contact about ROAR-approved track designs.

Keep up the great work!

JOHN GROLLIMUNO
Vandenberg AFB, CA

You can get information about track layouts from ROAR administrator Steve Whitney, 1203 Westview Dr., Cocoa, FL 32922; (407) 631-5827; fax (407) 633-4625.

LA

SPY CAM SEARCH

Please send me the address for Supercircuits so that I can order their catalogue.

JEREMY HIGGINS
Mitchell, MD

Jeremy, we've been inundated with requests for this company's address since we featured their Spy Cam in our "Christmas Wish List" (Car Action, December '92). If I print it, will all you squirrels promise to stop calling me 18 times a day for it? Promise? Come on; I know you're lying, but I'll give it to you anyway: Supercircuits, 13015 Debarr Ave., Austin, TX 78729; (512) 335-9777. And don't forget to tell them that you read about them in Car Action.

LA

CHRISTMAS PAST

In the "Christmas Wish List" in your December '91 issue, the Binks Chame-

leon airbrush was mentioned. Please supply an address for this company. I can't find one in my area.

TIM WICKTOR
Ft. Myers, FL

Reaching way back in those issues, aren't you, Tim? You can write to Binks at 9201 W. Belmont Ave., Franklin Park, IL 60131. Tell them you saw it in Car Action.

LA

DOWNSCALING

I had a 1/52-scale Pit Gear mini racer on my Christmas wish list, too, but when I contacted Impulse Inc., they told me that they no longer handle this car. Thinking back to the July '92 review, I tried FAO Schwartz toy store, but no luck there either. Any suggestions?

In your September '92 "Inside Scoop," you displayed a 1/32-scale "monster truck" that's manufactured by Kashiwazaki Co. Ltd. I wrote to them about three months ago, but I still haven't received a reply. Any additional info on availability in the States yet?

JEFF TEDRICK
Hagerstown, MD

Jeff, for the Pit Gear, you might try PJ Int'l, P.O. Box 18113, Anaheim, CA 92817; (714) 282-1876; fax (714) 637-0213.

Still no word on the Kashiwazaki truck, but we'll keep you posted.

LA

KUNIO QUERY

I'm interested in buying a Dudgeon Racing Gas RC10T conversion kit. Could you please give me the address or phone number so I can order one? I love your magazine; keep up the good work!

MATT SEELER
Leavenworth, KS

You can order Kunio Dudgeon's conversion kits from A-Main Racing, 3731 W. 95th St., Overland Park, KS 66204; (913) 383-9481. Tell them that Brigitte sent you and she wants those photos back before they fall into the wrong hands.

LA

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Would you give me a new car and I will give you my old? Or give me a battery pack. Please. Thank you. I'll pay you next year when I get my check. I want a fast fast car.

JOE SUMMERALL
Daytona Beach, FL

Tell you what, Joe. I'll send you my '88 Cordia and all the battery packs you could possibly want if you send me a '93 Miata. I want a black black black convertible—but I'll take racing green if I have to. Don't forget the leather interior. Thanks.

LA

WORLD SCALE WONDERS

I've just finished reading your January '93 issue. They just keep getting better.

How long will it be until we see Track Reports on MRC's new World Scale vehicles? These have my adrenaline going already. I can definitely see a Thunder King in my future!

CRAIG O'NEAL
Nashville, GA

Don't hold me to this, but we have reviews of the Thunder King and Baja King lined up for the April and July issues, respectively. We'll do our best to keep on schedule.

LA

CONFUCIUS SAY AGAIN

In December '92, B.D. Phillips of Concord, NH wanted to know about the different styles of motors ("Confucius Says").

You told him to read "Becoming Unwound" in the October '92 edition of "Troubleshooting." I've wanted the answer to that question for some time; I searched and searched for it, but I didn't receive my October issue. Can you help me?

MARK CARTER
Noblesville, IN

*Here's a reprint of Frank's answer:
"Basically, the number of turns refers to
(Continued on page 138)*

MAP

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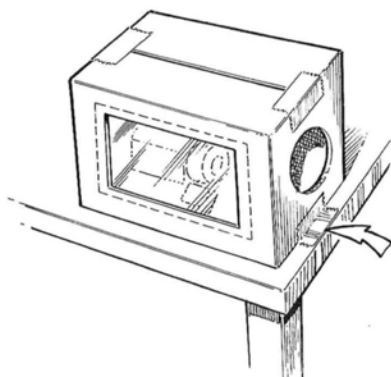
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PIT TIPS

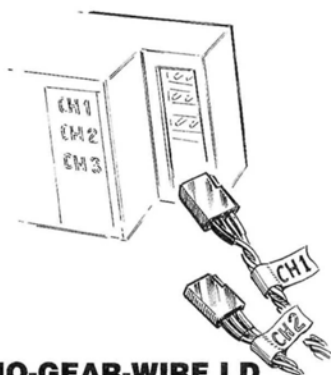
by JIM NEWMAN



CLEAN TIRE TRUING

Cut a window in the side of a large cardboard box, tape clear plastic to the inside, and cut hand holes in the ends, as shown. When you true tires inside the box, all the rubber dust is contained, and it can be emptied straight into the trash can.

Brandon Bunger, Greenville, OH



RADIO-GEAR-WIRE I.D.

Wrap strips of masking tape around your radio-gear wires as shown, then use a laundry marker to tag each wire with its function.

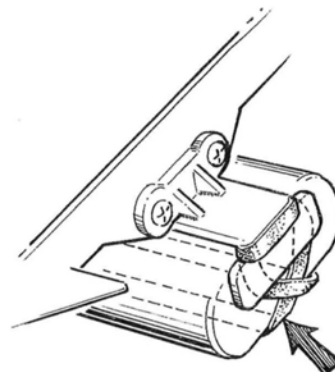
Don Sargent, East Ryegate, VT



COLOR-CODED TIRES

Color-code your tires to show which compound each is made of. Punch dots out of self-adhesive labels that have been colored with waterproof markers. Clean each tire with alcohol, then apply the appropriate dot. You could also use self-adhesive colored trim tapes as markers.

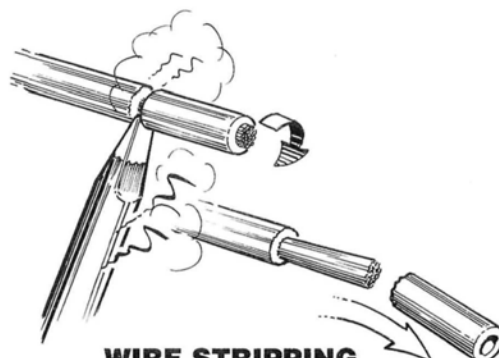
Garry Lamothe, Easthampton, MA



KING CAB BATTERY SECURITY

If you want to avoid having your King Cab battery packs come out during hard cornering, wrap a rubber band around the retaining tab on one side, and pass it under the car and around the tab on the other side.

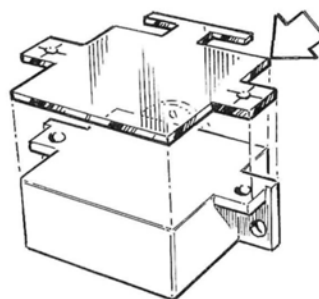
Jeremy Storer, Hagerstown, MD



WIRE STRIPPING

Strip the insulation off wires by using a hot soldering iron as shown. Rotate the insulated wire against the iron's tip, then pull off the unwanted insulation.

Greg Horne, Riverside, CA



SERVO TEMPLATES

If you often install radios, it will be worthwhile to make a set of scrap-Lexan® servo templates. Mark where the centers of the holes will be, drill small pilot holes, then cut out the templates. These templates are often more convenient to use than the actual units.

Frank Barba, Wilmington, DE

Radio Control Car Action will give a one-year subscription (or one-year renewal if you already subscribe) for each idea used in "Pit Tips." Send a rough sketch to Jim Newman, c/o Radio Control Car Action, 251 Danbury Rd. Wilton, CT 06897. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we cannot acknowledge each one, nor can we return unused material.

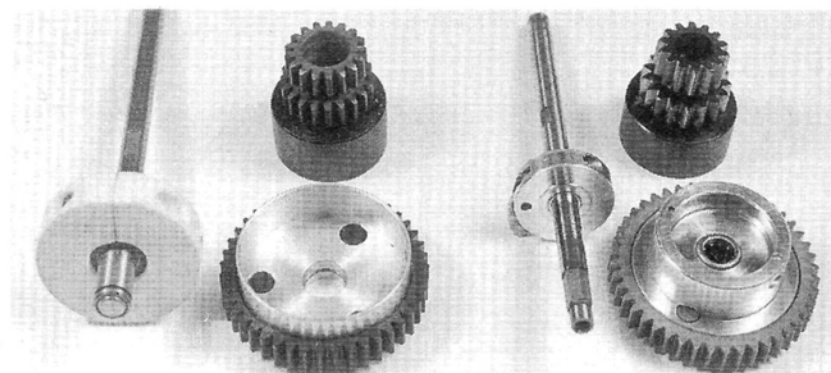
NITRO NEWS

SHIFTY BUSINESS

by JEFF BRONSTEIN

OK, YOU'VE BEEN thinking about making the big "shift" to gas racing; well, here are two *more* reasons: first and second gear. Because 2-speeds are prohibited in most forms of electric racing, many racers are unaware of their existence. In fact, multiple-speed transmissions have been around for many years in 1/8-scale gas on-road competition. Even the 3-speed transmission is making its debut in competitive racing. And, for all of you 1/10-scale gas racers, the 2-speed will probably be approved for ROAR 1/10-scale, .15-class, on-road racing. Even for experienced racers, understanding multiple-speed transmission can be a "shifty" business.

Although gas engines are much more powerful than electric motors, they usually produce less torque at low rpm. In the past, selecting a gear ratio for a gas car meant sacrificing either acceleration or top speed. Tracks with long back straights and tight infield corners were the domain of the "50-percent-plus-nitro club." Multiple-speed transmissions expand the performance of both cars and engines, so now a car can accelerate quickly and reach a higher top speed while its engine's



The Serpent two-speed (left) has two spring-loaded half-moon-shaped clutch shoes. As rpm increase, the shoes expand and engage the clutch-bell assembly. The new Serpent cars have an improved 2-speed and numbered spur gears. The BMT 2-speed (right) has a spring-loaded cantilever drive ratchet. It opens as rpm increase, engaging a small pin inside the second speed housing.

rpm and torque stay within narrow peak-performance limits.

The concept of a fully adjustable, automatic, multiple-speed transmission sounds intimidating, but the mechanics are fairly simple. One set of gears accelerates the car to a specific range of engine rpm, at which point, a second set of gears is engaged. (See diagram.) Both sets of gears are mounted on the engine crankshaft and

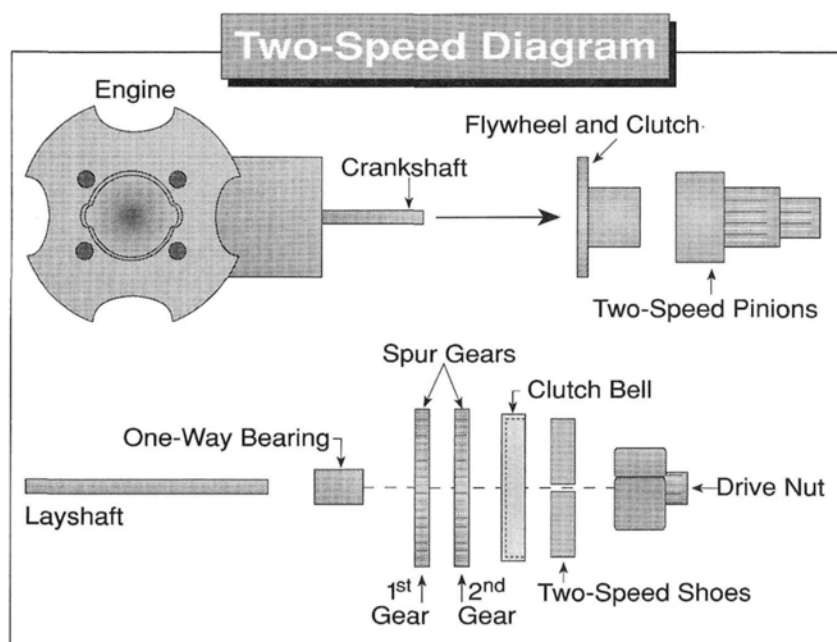
jackshaft (mid-shaft). The two pinion gears always move together, moving the two spur gears at different rates. As the engine applies power, the first set of gears engages the jackshaft by way of a one-way bearing. By itself, this setup is identical to most electric direct-drives, except for the bearing. The second spur gear is mounted on a spring-loaded centripetal-clutch system; it's similar to the engine clutch, but it engages much later. It spins freely on the clutch system when disengaged. When the engine reaches a specific rpm, the 2-speed-transmission clutch engages and the second set of gears begins to push the jackshaft, while the first set of gears spins freely on the one-way bearing. The shift is consistent and instantaneous.

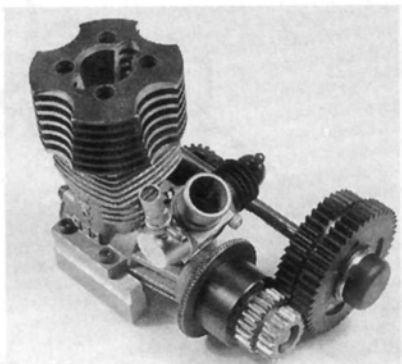
As it is in electric racing, gear selection is very important for proper performance. On fairly tight tracks, the gears of the 2-speed can be close in size to keep up the engine rpm and maximize acceleration out of sharp corners. Conversely, on long, wide tracks, the gear change will be larger to make the best use of both acceleration and top speed.

SETTING A 2-SPEED TRANNY

Always start with a large first-gear pinion and work your way down until there's

(Continued on page 14)





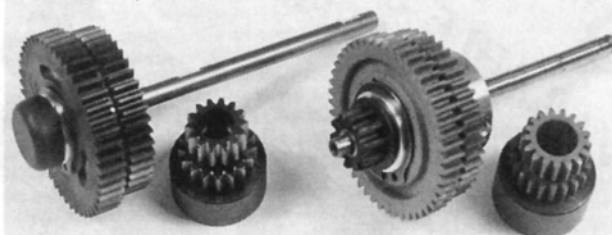
There are several gear-ratio combinations for these gears. For more subtle adjustments, change the spur gear.

adequate acceleration out of the corners. Don't worry too much about the shifting point until you've determined a possible first-gear ratio. As a rule, first gear should always reach the engine's maximum-torque range fairly quickly; then you can shift into second gear, where the larger pinion can max out the topspeed. After you've chosen your first gear, base the selection of second gear on the length of the back straight. The shifting transmission shouldn't bog down the engine, but you should always have a large enough second gear to allow the car to achieve maximum speed on the straightaways. If you hit the back straight correctly, you shouldn't have to reduce the throttle until the engine is almost topped out. If the car still accelerates when you reduce the throttle at the end of the straight, you might be "over-geared."

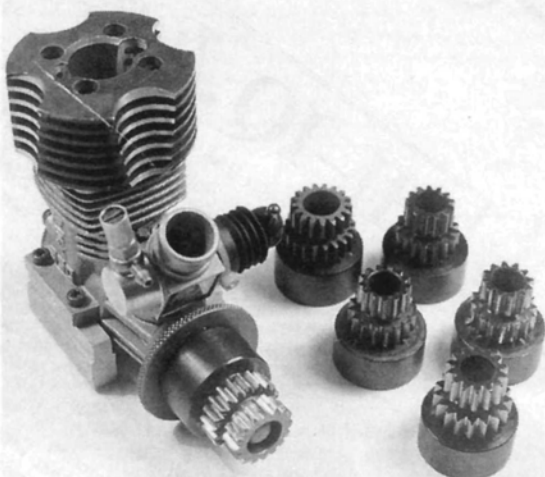
Adjusting the shifting point of the 2-speed is as easy as turning one or two setscrews. Some 2-speed clutch systems have a two-shoe system; others have a spring-loaded lever arm. Both types are adjusted by changing the spring tension against the centripetal force of the rotating clutch shoes. By tightening the spring against the clutch shoe, the shift occurs later; by loosening the spring, the shift occurs earlier. Depending on the track layout, the transmission should shift only on medium to long straights or wide ch-

canes. If the shift occurs too soon, the engine won't produce enough rpm to produce maximum torque, and acceleration will be hampered. If the shift is too late, you may risk over-revving, and again, the engine won't produce maximum torque. The shift should always occur just before the engine sound begins to fall off.

The initial setting of a brand-new clutch is sometimes difficult to determine. Before you begin, there should be very little drag in the transmission (watch the gear lash). If you spin the tires manually, the 2-speed gears



The (size) offset of the spur gears must match the offset of the pinions if the gears are to mesh properly. (In this case, the outside set is the first gear.) In the car, the 2-speed layshaft drives a belt that provides power to the front and rear axles.



The double pinion gear is mounted directly on the crankshaft of the engine with the clutch assembly and flywheel. In most cases, the pinion/clutchbell assembly is one piece, so you'd have to replace both, even if only one gear ratio needs adjusting.

should spin freely for at least two or three revolutions. If they don't, check for binding in the gear lash or bearing alignments. When the gears spin freely, you should actually hear and feel the 2-speed shift when you hold the car and apply the throttle slowly. Always ensure that the 2-speed is fully disengaged before you start to adjust the shoes. Loosen the 2-speed clutch springs roughly $\frac{1}{6}$ turn at a time, then repeat a slow acceleration until you feel a slight "kick" as the 2-speed shifts. This is close enough to get the car on the track for fine tuning.

At this point, the easiest way to locate the shift point is by listening carefully for a drop in rpm on the track. Because other

engine sounds may make hearing the shift difficult, it's best to fine-tune the 2-speed when no other cars are on the track. The back straight is always a good place to observe performance.

Depending on the track and the speed with which the car enters the straight, the 2-speed should shift as the car settles into

a comfortable straight line. If the gearing is correct, the car's traction and the engine's torque should reach their peak simultaneously. The engine should stay "on the pipe" through the shift. The only way I can describe this sound is to say that it's a sharp drop in pitch followed by a strong recovery of acceleration. Listen for the shift and observe where it occurs on the track. If the shift occurs in the long, sweeping corner entrance to the back straight, it could create a momentary loss of traction and the car could break loose. The solution? Tighten the 2-speed so that the shift occurs on the straight. Until you get the hang of tuning the 2-speed, it may be best to set the shifting point so that it's engaged early rather than risk the possibility of throwing a connecting rod. (That can happen if you allow the engine to rev too high.)

Once you've dialed-in the shift point, very little maintenance is necessary. Tear down the 2-speed once in a while to keep it clean and free of debris. The one-way bearing is particularly susceptible to failure if it isn't maintained properly. Multiple-speed transmissions have come a long way in a very short time, and you can bet your clutch bells that you'll love 'em the very first time you hear the sound of a clean shift on the back straight. You know the sound. It's the one that all kids make when they play with toy cars. It's something that you just can't get out of an electric motor. Now that you know how they work, and how to keep them shifting properly, gear up for some "Car Action-packed" racing! ■

READERS' RIDES

"Readers' Rides" is our way of recognizing the unique, innovative—and sometimes bizarre!—vehicles that our readers have created. Send us a sharp, uncluttered, well-exposed color photo of your car or truck (no Polaroids, please!), along with a brief description, to Readers' Rides, R/C Car Action, 251 Danbury Rd., Wilton, CT 06897. If the Ayatollah of Radio Controlla chooses your photo, you'll receive a one-year subscription to Car Action, or an extension of your existing subscription. You'll also be eligible for the fourth annual "Reader's Ride of the Year Contest" in the fall of 1993. Write your address and phone number on your letter and on the back of each photo you send, in case we need to contact you.



DOG DAYS OF R/C

Tim Ehlers of Indianapolis, IN, told us that if we didn't print his "Readers' Ride" photo, he'd sic his friend's Boston terrier, Jabba, on us. OK, so maybe it isn't true. Anyway, Tim's ride is a Kyosho Raider that has been modified with a Trinity Slot Machine Motor and heat sink and full ball bearings. A Novak T-4 ESC transfers power to the motor, while the airwaves are controlled by a Futaba Magnum Jr. Tim painted the Clod Buster body himself using Richard Muise's designs.

SLIGHTLY ALTERED

This stunning Clod Buster is from Tom Faircloth of Longmont, CO. To modify his Clod, Tom added a custom-made cowl hood, a visor, a cab extension and the custom-made aluminum wing on the back of the bed. The liner is made of "diamond plate" steel. An ESP chassis brace makes the chassis more rigid, and the multi-link suspension enables this beast to travel over almost anything. A Novak speed controller, two Trinity Matched Madness motors and a set of Sees aluminum rims with knobby tires make this Clod move.



DESERT DUELER

Eric Williams of Banning, CA, took a stock Tamiya King Cab and turned it into his own version of the Nelson and Nelson desert-racing Chevy. The chassis and shock towers are handmade of aluminum, and it rolls on Schumacher tires and Sees aluminum rims. A Novak 410-M5 gets the juice to a Peak Performance 11-turn triple. To handle the power of the motor, Eric added a Thorp ball diff, a center gear brace, a Robinson spur gear and a pinion. To complete his truck, Eric had his Andy's Chevy body custom-painted by his friend Larry Ragland.





INSIDE SCOOP

by CHRIS CHIANELLI

IN SEARCH OF FUN GLORY AND THE GOODIES THAT WILL HELP YOU GET IT!

MR. DAHM & HIS 8th WONDER

Ira Dahm (of Dahm's Racing Bodies) has always produced something different and, at times, downright outlandish. Some may raise an eyebrow at his risk-taking creativity, but the company has been around for years, and Dahm's bodies are very popular with both R/C fun-lovers and racers. The Buggsy shown here is just one of Dahm's new 1/8-scale bodies. It fits the Inferno, the Nitro Crusher, the Burns, the Pirate, the Mugen and most other 1/8-scale off-road cars. Also new is a cool-looking aerodynamic "fastback" 1/8-scale racing truck body—the Commando XL8. For more info, contact Dahm's Racing Bodies, P.O. Box 360, Cotati, CA 94931; (707) 792-1316.



A 22-inch-high, 49-inch-long R/C Godzilla! Think of the possibilities! Imagine how you'll scare the prissy occupants of your sister's doll house—and drive your sister insane—as you crash Godzilla's jaw-wagging head through the little window while making it bellow that famous Godzilla howl (kind of like an out-of-tune nuclear saxophone). Now, don't write and ask where to get it, because I don't know yet; these are only spy shots. Let me assure you, however, that this thing *does* exist and is radio-controlled. I'll get more info for my loyal "Scoop" readers, even if it means returning to Japan in my Raymond Burr disguise.



Mothra Move Over



THAT WAS THEN



Some call him "brilliant"; some call him "maniacal"; some call him the Penske of R/C car racing; but those who know Trinity President Ernie Provetti call him "committed"—no, not to a mental institution, but to the continued

THIS IS NOW



growth and endurance of R/C car racing. The top picture of Ernie was taken in 1978 at the Slot-Car World Championships in Goteborg, Sweden (nice shirt, Ernie); the picture at the bottom shows today's Ernie with Yasuo Yanagi, who's president of Sanyo North America. Ernie has been around a long time, and he understands the industry, both as a modeler and as a manufacturer. His success story is the result of hard work and putting something back into the sport of R/C car racing.

BORN TO SPEED

Protoform's Isedra Commendatore body was designed for one purpose: to go as fast as possible especially at high-speed oval events like Thunderdrome's Insane

Speed Run and others at large oval speedways and velodromes. The Commendatore's primary mission dictates a low drag coefficient and straight-line stability. You can dial-in just the right amount of downforce for a specific track by adjusting the rear spoiler and front "rail" or fins. For more information, contact Protoform, 4444 Fieldgate Dr., Unit 15, Mississauga, Ontario, Canada L4W 4T6; (416) 646-7638; fax (416) 625-5171.



Tamiya continues to be a prolific producer of new cars. Above left is Tamiya's latest in the budget 4WD arena—the Terra Conqueror, which is based on the shaft-driven Top Force. Below is Tamiya's latest addition to the growing F-1 wave—the Footwork Mugen Honda FA 13. Above right is the Dyna Storm. You may remember that in the January '93 issue of "Scoop," I told you about the experimental Tamiya Race Factory (TRF) 211—Tamiya's all-out competition buggy. Well, the Dyna Storm is basically the production version of this, and it will have arrived in America by the time you read this. This car has all the features it needs to win.

3 from Tamiya



FASTEST IN ITS CLASS

Team Bolink's Steve Rule used this Bolink Lola T-91 body on his Bolink LTO™ SS to go an incredible 76mph at the 1992 Thunderdrome. Rick Hohwart also took Bolink's '91 T-Bird body (not shown) to a record-breaking 79mph in the stock-car class. Bolink is in the speed business, for sure! For more information, contact Bolink R/C Cars (RCA), 420 Hosea Rd., Lawrenceville, GA 30245; (404) 963-0252; fax (404) 963-7334.

Up for Grabs!



That's right!—Neato Motors is now taking bids for the distribution rights of its new 1/8-scale, gas, F-1 car! Just listen to some of its features: port-direct, atmospheric-entry, exhaust system; "unintruded" smooth-body venturi induction; finite, direct, torque-lock, single-wheel drive (requires a push-start, but that's the price of performance) and polystyrene-reinforced, pressed-aluminum chassis for high-speed "compressibility." Wow, fellas! Is this thing keen, or what!? Owing to its high speeds, titanium tethers are strongly recommended. It's very hard to say who will win the rights to distribute this beauty. Rumor has it that Associated is looking for a new car on which to hang the name "R/C Warp 10." This could be it. I've also heard that Losi is looking for such a car to spearhead its re-entry into on-road racing. This one is a tough call; my vote, however, must go to Trinity. After all, it's a huge player in the gas-powered R/C car business. To place your bid for distribution, contact Neato Motors, Salt Flats Cir., Burbank, CA 00001 (ask for Bif).

ZIP PAK™

Professional Power for Pennies...



It has been said the human hand is better than a computer at assembling battery packs. Don't believe it! Computers don't have bad days. They don't break up with their girlfriends and they don't have headaches. People do. That's why they don't always do the same job the same way twice. They're only human.

That's why Trinity uses an exclusive, computer-controlled, automated assembly system for their Zip Pak. Reliability and consistency are programmed in and never vary.

This automation is combined with the very finest materials. The cells are Sanyo KR1300SC (1300mAh) and there has never been a world champion that didn't run Sanyos. They've never lost! All tabs are pure nickel and as short as possible to minimize resistance. Each is double welded, and all wires are pure copper with silicon insulation. The entire assembly is pressed into a precision fitted tube which protects it from the rough and tumble world of racing.

As the bare, assembled pack nears completion, it is connected to an instrumented quality control panel which measures all facets of the pack's performance. Only then is the Zip Pak label applied.

The result is the lowest cost, highest quality sport pack available.

Buy several as back-up spares. Never be short of power.



TRINITY

Trinity Products Inc

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KYOSHO..... On & Off the beaten track

Although this Kyosho 1/10-scale, 4WD, Pajero Rally car might never make it to the States, I think you deserve a look at it. It has a long, double-wishbone suspension, oil-filled coil-over shocks, a Le Mans 05 motor, a twin-belt drive and block tires.



AUDI V8 QUATTRO

This gas-powered Audi Quattro from Kyosho is a 1/8-scale version of yet another contestant in sedan racing, which is tremendously popular in Europe. Mercedes, BMW and Audi are heavily involved in the European stock-car-style of full-scale racing. Based on the Inferno, the Kyosho Quattro features fully independent suspension, a pull-start engine and a transversely mounted, dual-outlet, exhaust system. Availability unknown.



Winning by Design

• The TRINITY Championship Series™ •

Trinity's Championship series of motors is well named. The 1991 record books clearly show the Championship Series has been the hands down winner in all types of modified racing.

1991 NORRCA 4wd Dirt Oval.....National Champion
1991 ROAR 1/10th On-Road.....National Champion
1991 ROAR 2wd Dirt Oval.....National Champion
1991 ROAR 2wd Off-Road.....National Champion
1991 ROAR Monster Truck.....National Champion
1991 Cleveland Indoor.....National Champion

Championship motors are fast and are the first specifically designed to use Sanyo's new 1700SCRC and Panasonic's P170 SCR batteries.

RC1700	Nuclear Meltdown™	(9T, Dbl)	\$80
RC1777	Kevin, Kevin™	(10T, Trpl)	\$80
RC1778	Helter Skelter™	(11T, Quad)	\$80
RC1779	Speed Metal™	(12T, Trpl)	\$80
RC1780	Flash Point™	(13T, Sngl)	\$80
RC1781	Buzz Saw™	(14T, Dbl)	\$80
RC1782	Armageddon™	(15T, Quad)	\$80
RC1783	The Classic™	(16T, Quint)	\$80
RC1708	Joel Magic Johnson®	(17T, Trpl)	\$80

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INTELLIGENT CHARGING



There are many battery chargers from which to choose, and most claim to perform at least one kind of magic, but it's pretty plain that there really are only a few basic methods of charging: linear charging, pulse charging, the classic "charge" cord, and one other—commonly called reflex charging.

type of charging will allow a battery pack to reach its full capacity, and this means increased battery performance.

The IQ-Flex is a very compact 4.5x2.5x1.5 inches. (This doesn't include the thickness of the optional muffin fan.) The charger has a brushed-aluminum face and a large back case that serves as the heat sink, too. On the face are four controls. On the left are two adjustable control potentiometers that you can use to set the charge current and the burp current. The charge current ranges from 0 to 8 amps. This might not sound like a lot, but no one in his right mind charges a pack more than at 8 amps. Let's just say that a rate that high is risky to the life of the pack.

The burp rate can range from 0 to 40 amps. Obviously, if you don't want the burp feature, simply dial the amp rate to zero, and you have a linear charger. The instructions mention that the factory-recommended setting for burp-charging is 20 to 30 amps, and you're encouraged to experiment with this.

Along the lower edge of the panel are four high-intensity LEDs:

- The "fault" light tells you when there's a problem with the battery pack or with the hookup, e.g., reversed polarity, a bad cell, an incomplete circuit, etc.
- The "overheat" light tells you when the IQ-Flex is too hot to operate.
- The "charge" light indicates two things. When it shines steadily, the charger is feeding power to the pack. When the light begins to blink, the charge has been completed. When the pack is fully charged, if you don't disconnect it, the IQ-Flex will continue to maintain the charge. This isn't the same as a trickle-charge, which is simply a

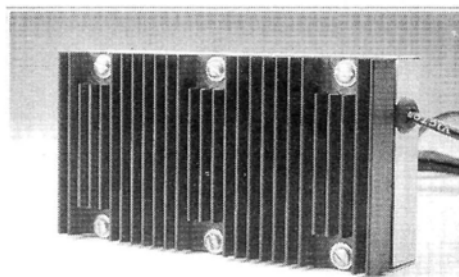
Victor IQ-Flex

by MIKE LEE

Reflex charging is a relative of pulse charging, in that the actual current being fed to the battery pack is pulsed in short bursts. (Tekin's BC210 charger did this.) Now Victor Engineering* presents a far more refined version of this idea—the IQ-Flex Charger.

The IQ-Flex Charger does things a little differently. This microprocessor-controlled charger works on the theory of "burping" a battery pack while linear-charging it. Gases and pressure build up inside a battery pack as it's charged. This buildup creates resistance and prevents the battery from being fully charged. During linear charging, a momentary, controlled load is placed on the pack to "burp" the pressure away and to allow the pack to be more completely charged.

Burping occurs approximately every second and is determined by the microprocessor. Victor claims that this



Victor's heat-sink case helps to keep things cool.

very low-rate charge. The microprocessor in the IQ-Flex monitors the pack's voltage and feeds a small power pulse to it *only* to maintain the voltage—no more and no less. This means that you could leave the IQ-Flex connected to the pack without overcharging and damaging the pack.

- The "final" light indicates when the pack is being

(Continued on page 58)

Mugen SUPE



WHEN I REVIEWED the Mugen* Super Sport in the June '92 issue of *Car Action*, it was the first 1/8-scale off-road car I had ever built and driven. At the time, I didn't think that it was possible for *anything* to go faster in the dirt than my Nova Rossi-powered 4WD missile.

My opinion changed after I attended the

Kyosho/*Car Action* Southeast Gas Off-Road Championships in Georgia. While I was worrying about such things as engine temperature (always critical) and clean air filters, the competition was busy adjusting differential loading (by packing their cars' diffs with lubes of various viscosities), making minute changes to their cars' damping

(just like in 1/10-scale off-road) and picking "dialed" sets of tires! One thought recurred: 1/8-scale off-road isn't a novelty class anymore. Winning is no longer simply a matter of finishing (as was true in some of the earlier events in this rapidly growing segment); to win, yes, you have to finish, but you also have to be fast!



by FRANK MASI

SPORT '93

Improving the Breed



FIRST-GENERATION SHORTCOMINGS

Although I did fairly well in Georgia (I qualified first and took second in the B-Main), I noticed several areas on my Mugen that, to make it competitive against the Infernos and the Super Pirates, could use some improvement. Chief among these was the need for a dual-disk-brake setup; without dual brakes, I had to spend time setting up for tight corners, while cars with dual brakes gained up to 5 feet on my Mugen because they were able to approach turns faster and brake later.

I also had a problem with the shock absorbers; once, during a qualifying run, I "tagged" a board pretty hard and apparently broke a shock shaft. In fact, the small screw that held the piston on the shock shaft had loosened and allowed the shaft to pull completely out of the shock body! Even though I rebuilt all four shocks, using thread-locking compound on each of these screws, this happened again in the Main; one of the rear pis-

tons came undone, and this made the car twitchy and hard to drive.

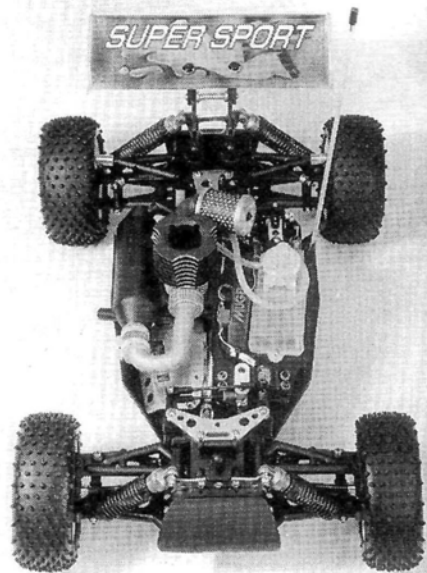
The original Super Sport chassis was made of aircraft-grade aluminum, so it was very rigid, but also quite heavy. To remedy this, I use a trick, aluminum-and-graphite chassis made by DA Graphite*; it's very light and strong, but it's also pretty expensive.

THE NEW EDITION

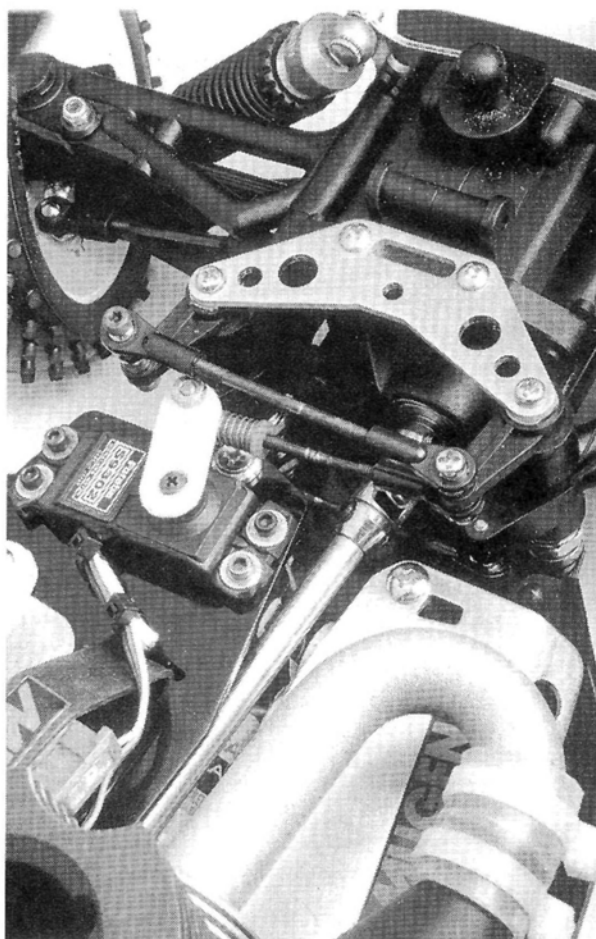
The latest version of Mugen's 1/8-scale 4WD off-road racer is the Super Sport '93, which includes all the upgrades that were used on the '90/'91 IFMAR World Championship-winning Super Sport.

To begin with, like the original one, the chassis is made of aircraft-grade aluminum, but the new version has been milled out and lightened significantly.

The new shocks are a vast improvement on the old ones. They feature blue-anodized aluminum bodies that are threaded near their tops



The Super Sport '93 is a refined, updated version of Mugen's Super Sport. Dual disk brakes and improved shocks are just two of its new features.



A dual-bellcrank, adjustable steering system keeps the front tires where they should be. Futaba's S9302 steering servo has ball bearings and brass gears—perfect for the rigorous requirements of 1/8-scale off-road.

MUGEN SUPER SPORT '93

Scale 1/8
Price \$649.99

DIMENSIONS:

Overall Length 17.5 inches
Width 12 inches
Wheelbase 12.625 inches
Front Track 10 inches
Rear Track 10 inches

WEIGHT:

Gross (w/bat.) .. 7 pounds, 11 ounces

CHASSIS:

Type Aluminum plate

DRIVE TRAIN:

Type 4WD
Primary Pinion (clutch bell) and spur
Differential(s) Planetary (3)
Bearings/Bushings Sealed ball

SUSPENSION:

Front: Type Upper and lower A-arms
Damping Oil-filled, coil-over shocks
Rear: Type Lower H-arm and upper camber link
Damping Oil-filled, coil-over shocks

WHEELS:

Front: Type Molded spoke
Dimensions (DxW) 4.125x1.75 inches
Rear: Type Molded spoke
Dimensions (DxW) 4.125x2 inches

TIRES:

Front Mugen SA50N 286 pin-spike
Rear Mugen SA50 286 pin-spike

POWERPLANT:

Engine Paris Rex modified*
Pipe Mugen SC-3B muffler*
Carb Rex slide valve*
* not included

OPTIONS TESTED:

Airtronics Caliber 3P; Futaba S9302 servo, JR Propo NES-2135 servo; Novak NER-3FM receiver; five Sanyo, 1000mAh cells; Bru-Line Proof switch. Mugen parts: S-1F exhaust manifold for Nova Rossi; S-8C flywheel for Nova Rossi; S-50 and S-50N inner tire foam; SC12L long engine nut; SC-18L long clutch bell (14 tooth); S-CA air filter set; AU-8 universal center drive shaft.

HITS

Smooth new shocks are vast improvements on the old • Dual disk-brake setup drastically reduces stopping distances • Very adjustable to suit track conditions • High-quality parts; good consumer support from distributor.

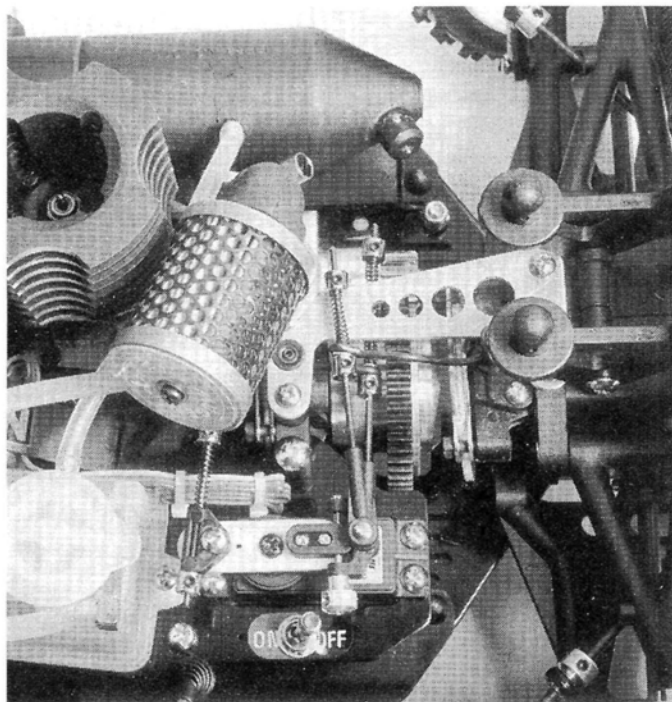
MISSES

Instructions need clarification to make building easier • Experienced help needed for some assemblies, e.g., pressing the roll-pins into the wheel hubs.

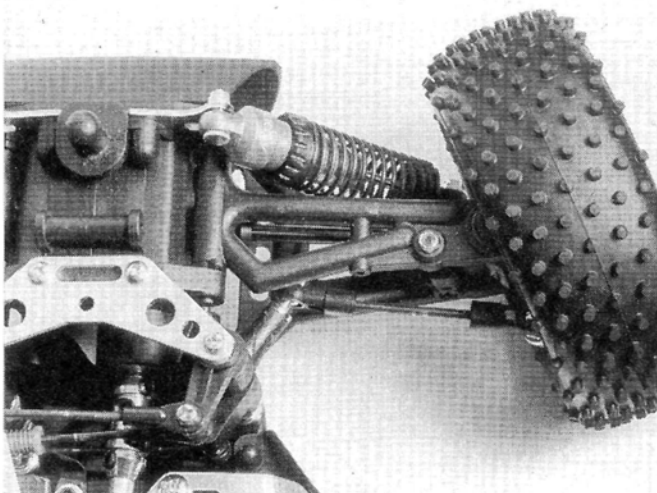
MUGEN SUPER SPORT '93

to allow the springs to be set quickly and easily. Most important, the '93's shock shafts are threaded so that the pistons can be secured with an aluminum-and-nylon locknut; they'll probably *never* come off! There are also new shock towers (with better geometry) and three sets of shock springs (firm, medium and soft) for front and rear.

The new Super Sport '93 comes with a dual-disk-brake system that should provide much more stopping power than the old, single-disk unit did. The disks are made of fiberglass and are attached to the center differential; the smaller disk stops the front wheels; the larger one halts the rears. Both brakes are fully adjustable, and they're actuated when the throttle servo is moved to the "brake" position.



Above: the throttle and the brakes are controlled by one servo. The linkage to the left of the photo is attached to the carb, while the linkage to the right actuates the dual disk brakes. Left: the Mugen's double-wishbone front suspension has adjustable camber and caster. A tie rod prevents the arms from separating during collisions. Right: the new shocks have pistons that are secured to their shafts by nylon locknuts instead of screws, which were prone to falling out.



BUILD-UP TIME

If this is your first 1/8-scale gas car, be prepared to spend more time at the workbench than you would if you were building a 1/10-scale electric car. One-eighth-scale off-road cars are sophisticated pieces of machinery, and attention paid to details and proper building procedures will really pay off at the track.

As far as the instructions go, read them carefully, because some of the text is confusing. The Japanese-to-English translations need some work in the clarity department, but the accompanying photos are clear enough to make up for the written instructions.

FRONT SUSPENSION

This is the first job to be tackled. Start with the steering hubs. When you secure the pivot balls to the hubs, be sure to use red Loctite*. In fact, use thread-locking compound on every metal-to-metal connection; engine vibration can soon

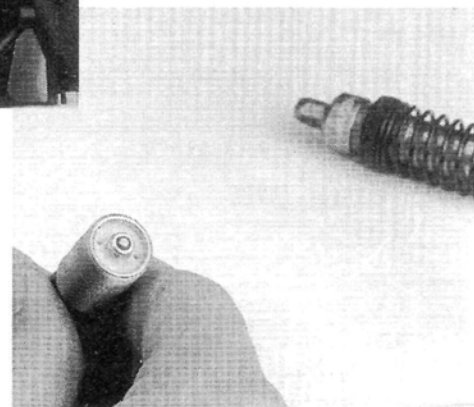
loosen screws and nuts. Assemble the universal-joint drive shafts for the front suspension; again, use thread-locking compound on the setscrews that secure the U-joints to the half-shafts.

The most difficult task is trying to press in

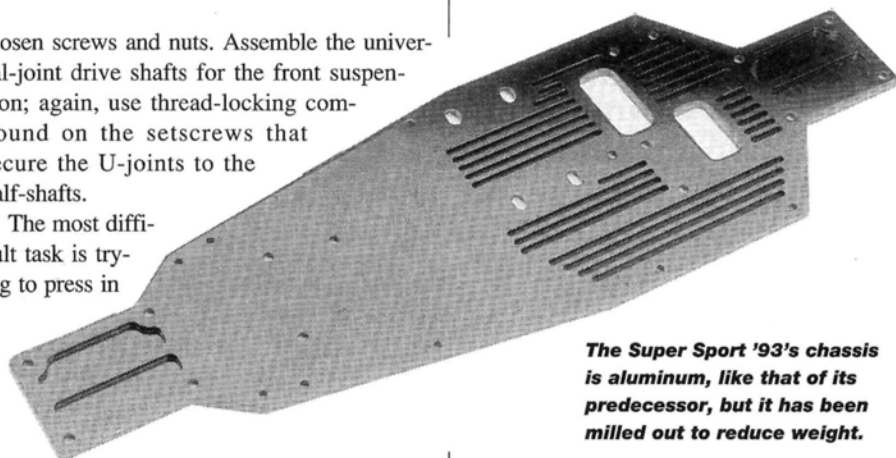
the roll pin that attaches the wheel hubs to the axles. The rears are already done for you, but for some reason, the fronts aren't. I found that the only way to press the pins into the hubs is by using a vise; get the pins started (make sure

that the hole in the hub lines up with the hole in the axle), and squeeze the entire assembly together *slowly*.

The front suspension consists of upper and lower A-arms. One set of arms is designated for the left side, and one is for the right side. Here's where the unwary can be confused; the steering hubs are labeled "left" and "right"—no problem here. Each pair of arms is, however, stamped with either a number one or a number two. Common sense would place the number-one arms with each other and the number two-arms together, right? Nope. Read the instructions very carefully here; each side of the front suspension has a number-one arm and a number-two arm.



The Mugen's caster and camber are adjustable. Caster can be varied by means of shims on the upper arms' mounting shafts, and camber is set by the positioning of the eccentric, upper mounting cups that secure the steering hubs to the upper arms. (Note: take care when assembling the upper mounting cups; be sure that the left and right sides are the same.)

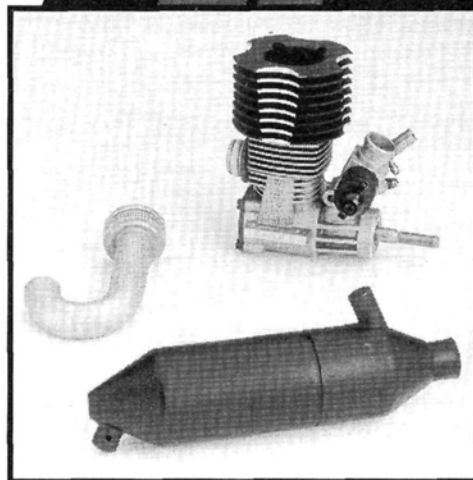


The Super Sport '93's chassis is aluminum, like that of its predecessor, but it has been milled out to reduce weight.

STEERING SYSTEM

The Mugen uses a unique, twin-bellcrank/servo-saver system that's one of the best I've seen. Each bellcrank pivots on an aluminum post that's threaded to allow the finger

Breaking-in a New Gas Engine



Nothing prolongs the life of your gas engine like a proper break-in period. It hones the moving parts, and it heat-treats the engine components so that they expand to their proper sizes. To break-in a motor, follow these simple rules:

- Always set the engine "rich" (set the carb to deliver more fuel than is necessary for engine operation) for the first three or four tankfuls of fuel. The engine should never lean out. The additional fuel provides vital lubricants that help keep the engine cool and carry away the small metal particles produced when a new engine is run.
- Never use fuel that's more than 15 percent nitro during break-in, or your engine might overheat.
- Monitor the engine's temperature frequently during break-in; avoid overheating it. The simplest method is the "spit test." Place some saliva on the cylinder head when the engine is up to its operating temperature; the saliva should boil away slowly (about five seconds is good). If it instantly sizzles away, the engine is too hot (the carb is set too lean, and it isn't providing enough fuel in the air/fuel mixture).
- Always run an engine with a load (the kind that's produced by driving a car); never break-in an engine on your workbench, or it will overheat. Pay careful attention to your engine's "vital signs"—its temperature and its sound. Listen for sputtering or any other unusual sounds.

Follow these break-in procedures, and your engine will last a long time and provide your car with all the horsepower it needs to carry you to the winners' circle.

nut, which is used to adjust the bellcrank's tension spring, to be tightened or loosened. The bellcranks are then connected to each other with two tie rods so that the shock from one wheel can be transmitted to the other to prevent bump-steer.

DRIVE TRAIN AND BRAKES

The Super Sport '93 uses the same, high-quality drive train as its predecessor: three planetary differentials with steel gears in an aluminum housing. Attached to its housing, the center diff has a spur gear that's driven directly by the engine. It's designed to bias power to the front and rear differentials. At one end of the center diff, there's an outdrive for the drive shaft to the front diff; at the other end, there's a pinion gear that's mated with the conical drive gear that's fixed to the rear diff housing.

Speaking of the front-diff drive shaft, I use Mugen's optional universal-joint shaft instead of the kit's dogbone type. On the forward part of the shaft, there's a universal joint that allows it to operate with less friction than the stock piece.

First, attach the spur gear to the center diff. Remember to use thread-locking compound. Mount the bevel gear on the rear differential case, and secure it with the bearing stopper. With the rear brake disk in place, slide the center diff into the rear diff case. Aligning the bevel gear with the center diff's gears might be a little tricky; try working the diff gears back and forth while sliding the diff onto the bevel gear.

The brake system is pretty simple. There are two disks—one for the front and one for the rear—and they're installed between two metal brake pads. When the brake is applied,

an eccentric camshaft presses one pad, which, in turn, presses the disk into the second pad.

When you're building the front and rear disk brakes, you must ensure that each pair of brake-pad fixing screws protrudes exactly the same distance, or the disks will be distorted when you apply the brakes. This is important.

REAR SUSPENSION

Like the front suspension, the rear suspension uses upper and lower A-arms. Things are much less confusing in the back of the car, so you should have no problem figuring out which arm goes where. The lower arms have arrows on them to indicate on which side they go, and the upper arms are marked for left and right.

Rear camber is easily adjusted by tightening or loosening the metal end piece of the upper arms (tightening it increases negative camber; loosening it will give positive camber).

The rear wheels have standard dogbones, but I'm toying with the idea of upgrading them with a set of universal-type front shafts for a suspension action that's more free.

Finally, the Mugen comes with two rear stabilizer bars that limit chassis roll during cornering. I recommend that you start with the thinner bar because it will improve your rear traction, and you can always change to the thicker bar if you need more steering.

"MECHA DECK"

In a modern 1/8-scale gas car, all the electronic components are mounted on an isolated deck that's called a "radio tray." (In Japan and in the Mugen instructions, it's referred to as "mecha deck.") This tray prevents the electronics from being damaged by engine vibra-

tion. Most trays are easy to remove for servicing, or when your car requires a thorough cleaning.

The Mugen's tray is made of aluminum, and it holds the steering servo, the throttle servo, the fuel tank, the receiver and the receiver switch. (I use Bru-Line's* Proof switch.)

The receiver can be mounted in two ways: use the kit's heavy-duty rubber band, or use the rubber receiver case. I chose to install my Novak* NER-3FM receiver on the tray with the rubber band, since that method allows easy access to the crystals. Since there's a good chance that fuel from the tank may spill onto the receiver, I might re-install it using the rubber case for protection.

The tray is mounted on the chassis by means of molded-plastic posts. Mugen also includes an aluminum post that braces the tray where the steering servo is mounted to prevent unwanted flexing.

HEAVY HORSEPOWER

To run the Mugen, you'll need to supply an engine, a battery pack to power the radio (I use five, 1000mAh cells), fuel, a glow-plug igniter, a flywheel for whichever engine you use, an exhaust pipe and manifold, a hand-held, 12V starter or a starter box, and fuel and air filters.

I chose a Ron Paris* modified Rex buggy engine. It comes with a competition-ready, slide-valve carb and a large, finned, aluminum heat-sink head to keep it running cool. The engine's crankshaft has to be shortened to make it work with the flywheel and clutch assembly. To determine how long it should be, I temporarily attached the flywheel, measured

(Continued on page 62)

SCOPING OUT

NOVAK 410 HPC

by JOHN RIST

THE LEADERS in the speed controller world constantly take aim at each other; each tries to be the best of the best. Novak* just fired its latest shot—the 410-HPc with HyperFETs. This could be a “shot” heard ‘round the world. Its “on” resistance—0.0015 ohm—is impressive.

A quick look into the box that held this racing-style ESC turned up several features that should make it a hot one:

- seven FETs (five for forward, two for brake)
- built-in, easy-to-set current limit
- built-in pots and pulse-checking for setting neutral and full throttle

• 12-gauge motor leads and low-resistance HyperFETs

• high-frequency motor control
The kit also includes an instruction book, heat sinks, universal receiver connectors, 12-gauge wire, a full set of capacitors, a Schottky diode, mounting tape, adjustment-hole dirt plugs, a hot Novak decal and a screwdriver.

I have a few comments about the features. I was pleased to see the two braking FETs. They should substantially help to eliminate wimpy brakes. They should also reduce the possibility of auto thermal shut-down that overheated FETs can cause.

The current limiter is a small knob with a pointer that can be adjusted between 20 and 140 amps. It replaces the normal current limit adjustment pot and test point. With this arrangement, all you do is turn the knob to the desired current and go racing. If racing results indicate that you need more or less punch, it's easy to raise or lower the current.

The high-frequency motor control will extend the life of your battery and brushes and will help your motor to run cooler.

This ESC is equipped with an elec-

tronic reverse-voltage protection device that eliminates the need for a reverse-voltage fuse. If you accidentally connect the battery backwards, the auto-reverse voltage-protection device will save the 410-HPc from burning up. Because of this device and the two braking FETs, there wasn't any room for the Schottky diode in the controller itself. Instead, Novak installed the diode across the motor's brush hoods. In this location, it does a better job of controlling motor noise.

largest part is a custom-integrated circuit that, in truth, is a miniature computer. The solder joints look extremely good and all of the current-carrying circuits on the printed circuit board are massive. When you re-assemble the 410-HPc, make sure that the current-limit knob points to the correct numbers on the decal.

RESISTANCE RECORD

Low “on” resistance means that the speed controller delivers all of the battery voltage to the motor. With 12A of current, I

measured a 0.04V drop along the length of the wire; the resistance was an incredibly low 0.0033 ohms. Two inches along the wire,

I measured a 0.03V drop for an “on” resistance of 0.0025 ohms—truly world-class-low “on” resistance. This ESC has the lowest “on” resistance of any I've tested.

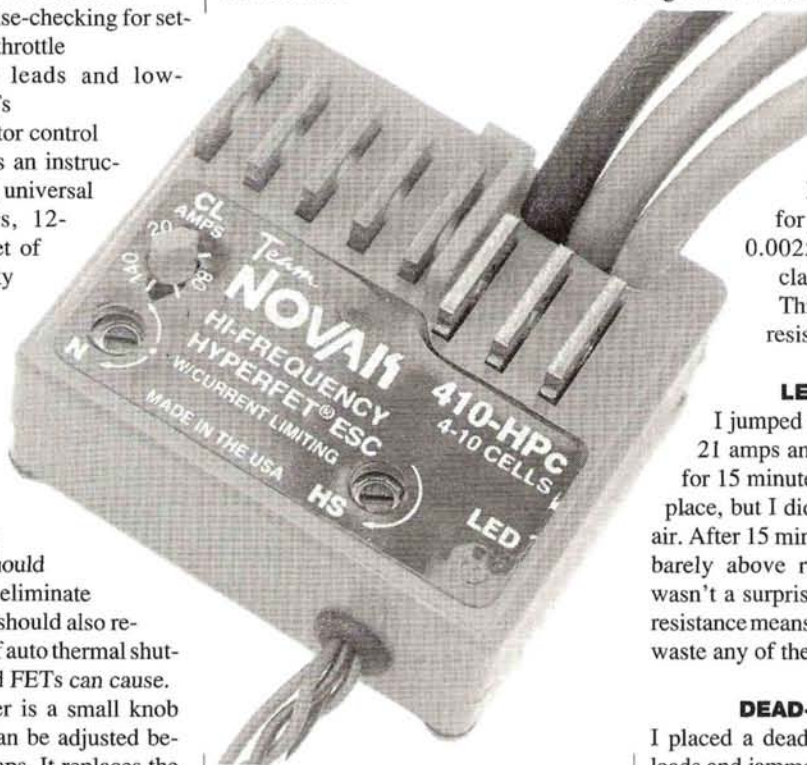
LET-IT-COOK TEST

I jumped the current up to a hefty 21 amps and let the controller cook for 15 minutes. I ran the heat sinks in place, but I didn't provide any cooling air. After 15 minutes, the heat sinks were barely above room temperature. This wasn't a surprise, because the low “on” resistance means that this controller won't waste any of the battery power as heat.

DEAD-SHORT TEST

I placed a dead short across the motor leads and jammed the pedal to the metal. The current jumped to 47A (the limit of my bench supply). I left the controller this way for one minute to see if its auto thermal shut-down would be activated. At the end of the minute, it was still pumping current normally and its heat sink was a little hot, but not too hot to touch. I'm sure that it wasn't close to thermal shut-down. In fact, it would be

(Continued on page 38)



The 410-HPc's case comes apart very easily. There are four screws in its bottom; once they're removed, the case splits in half. The two halves fit together very tightly, and the whole controller should be dirt-proof if you install the adjustment hole plugs.

It looks more like the inside of a satellite than an R/C speed controller. Its

Novak 410-HPc

DIMENSIONS:

Height (with heat sink) 0.84 inches
 Width 1.4 inches
 Length 1.58 inches
 Weight (with wires) 1.6 ounces

TUNING:

Access to controls Excellent
 Ease of adjustment Very good

PRICE:

Suggested retail \$195
 Warranty 90 days

ELECTRICAL:

(Manufacturer's specs)

Max. number of cells 10 cells
 Min. number of cells 4 cells

COMMENTS:

Novak has introduced a world-class racing speed controller that uses HyperFETs to achieve amazingly low "on" resistance. Other resistance-reducing features include a monstrous 12-gauge battery, motor wires and very heavy copper circuit runs that tie the FETs together on the printed circuit board. Its dual-brake FETs should eliminate brake fading and thermal shut-down. The calibrated current dial makes it easy to match the current level to track conditions.

Continuous current 300 amps
 Resistance 0.0015 ohm

TEST PARAMETERS:

Voltage 6 volts
 Current 12 amps

TEST RESULTS:

Voltage drop along length of wire 0.04 volt
 Voltage drop 2 inches along wire 0.03 volt
 Resistance to end of wire* 0.0033 ohm
 Resistance 2 inches along wire* 0.0025 ohm
 BEC output, 6-cell battery 5.85 volts

*voltage drop ÷ current = resistance

scary to pass enough current through this controller to cause it to shut down. Just remember, however, that a Ni-Cd battery pack can deliver a true 100 amps into a dead short. If your car isn't running properly, back off the throttle and find the problem. Use a little common sense.

SETUP

The 410-HPc's instruction book is very detailed, and it covers just about any problem you might have with its set-up. A detailed chart shows how to set the various adjustments found on most popular transmitters. Follow these settings because if any of the transmitter adjustments are wrong, it may affect your car's throttle range and linearity, and decrease its "driveability."

Now, it was time for fun! Since the local racing season was over, I mounted the 410-HPc in my Kyosho Sideways. It's my favorite non-racing test bed because with its big tires, it will run on almost any surface. I equipped my car with a Speedworks Boss motor and a Futaba Magnum Jr. radio. The instructions recommend hard-wiring the controller to the battery and motor. I prefer to use a Litespeed connector for the battery and to hard-wire the motor. The 410-HPc is a 3-wire (rather than a 4-wire) controller. Novak includes a length of 12-gauge wire to be used as a "jumper" between the

battery and the motor's positive lugs.

The red wire on the 410-HPc is smaller than the black and the blue wires because this red wire carries very little current. The only major current contained in a red wire is the current flowing from the battery to the motor.

The last step in installing the speed controller is to place the three motor caps and the Schottky diode on the motor. Be careful to install the diode properly because it will blow up instantly if you put it in backwards. This won't hurt the speed controller, but you'll be shopping for a new diode.

With the controller installed, I set up my Futaba Magnum Jr. radio to match it. I set all of the controls on my transmitter, and I adjusted the neutral pot. To aid in setting this pot, the controller has a red LED that comes on when you hit neutral. Next, I squeezed the throttle to the 80 to 90 percent point and adjusted the "HS" pot for full "on" performance. When the wide-open point was reached, the LED lit up bright green. The 410-HPc was easy to set up. If you hold the car off the ground and barely advance the throttle, you can hear a high-pitched whine before the wheels start to move. This is caused by the high-frequency motor-drive circuit in the Novak 410-HPc, and it means that your car is ready to run.

**THE SECRET TO ITS
 OUTSTANDING
 PERFORMANCE IS ITS
 ALMOST UNBELIEVABLY
 LOW "ON" RESISTANCE.**

ROAD TESTING

For the first run, I set the current limit to maximum (140A on your current control dial). The moment that I dropped the Sideways on the pavement and pulled the trigger, I knew that I had a winner on my hands. This controller's acceleration and speed is second to none. I drove on the imaginary road course that I had laid out on the parking lot. The brakes were strong, and after four minutes, the car was still running well. After the first run, I checked to see how hot it was. The battery was very warm and the motor was too hot to touch, but the HPc's heat sink was still at room temperature.

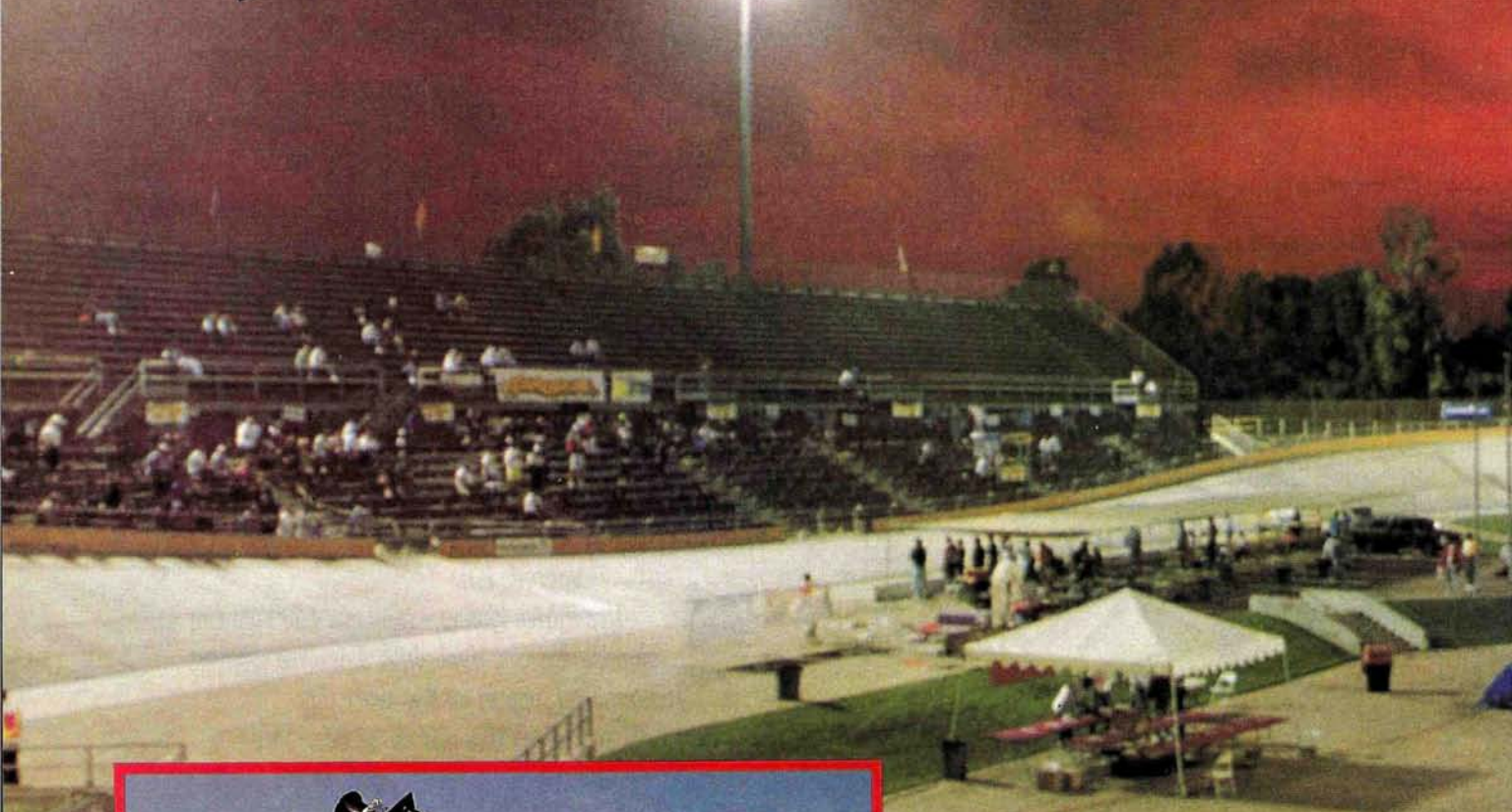
On the next run, I set the current limit to 20 amps (its minimum). Acceleration was still good, but it was almost impossible to spin the wheels. Top speed seemed unchanged and run time improved some. It was a fun driving session. The Novak 410-HPc is a hot speed controller that runs cool.

People say that I've never seen a speed controller that I didn't like. This is somewhat true because just about all of today's speed controllers are commendable and there's a wide range of capability and price among them. My investigation places the 410-HPc at the top of the pile. Its 10-cell limit precludes it from being in 28-cell class truck pulls, but it has what it takes to compete in any class that uses four to 10 cells.

The secret to its outstanding performance is its almost unbelievably low "on" resistance. There was also very little difference between the resistance reading taken on the full length of the wire and that taken two inches along the wire. I attribute this to incredibly large battery and motor wires. I predict that the Novak 410-HPc will start showing up in the winners' circle at every level of racing, from local fun runs to serious international title runs.

**Here's the address of the company that's featured in this article:*
 Novak Electronics Inc., 128-C E. Dyer Rd., Santa Ana, CA 92707; (714) 549-3741. ■

RETHUNDER



PHOTOS BY JOHN HOWELL

Cliff Lett, winner of the 150-lap, Pro Superspeedway race. Kent Clausen was a close second, and Gary Hamilton finished third. Pictured with Cliff are his pitmen, who were instrumental in his victory.

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Radio Control
CAR AC

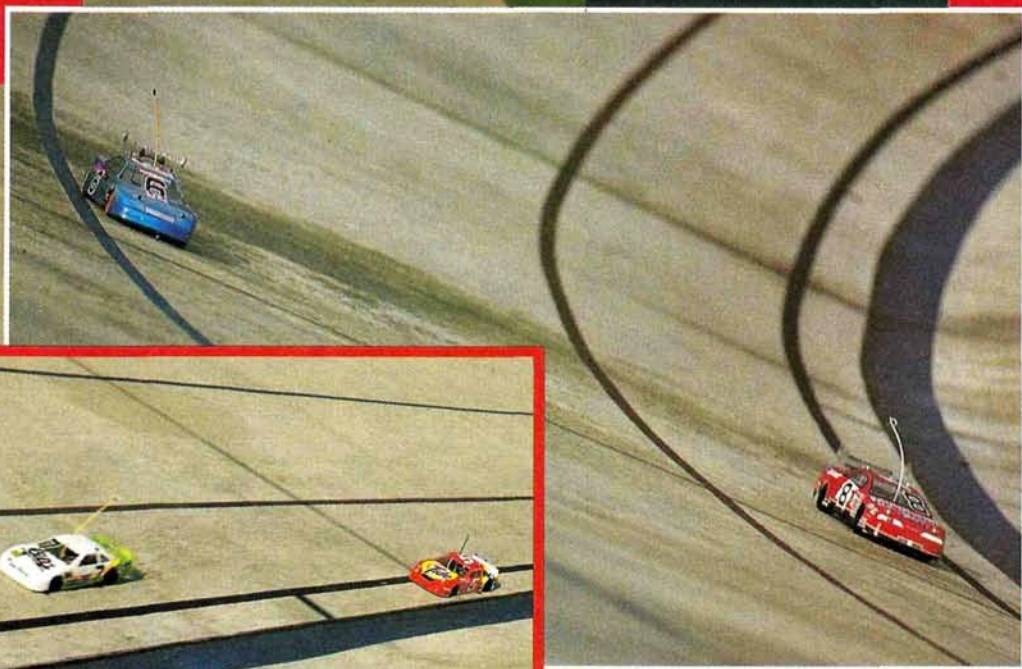
AND

Futaba

ROME[®]

by FRANK MASI

"COME ONE, come all!
It's the greatest R/C racing spectacle of all time! Don't be shy; charge your batteries, put your car on the 1,250-foot-long bicycle track and test your luck. You'll witness the incredible Insane Run cars as they reach speeds in excess of 80mph; you'll see exhibition races of 1/4-scale behemoths and, in addition to the standard, 4-minute Sportsman and Expert Stock and Modified classes, there's a special class in which the pros compete—the *Car Action Superspeedway Shootout.*"



The Insane Speed Run has to be the largest attraction at the Thunderdrome. Spectators line the track to watch these specially built, electric-powered land missiles compete for the title of "World's Fastest R/C Car."

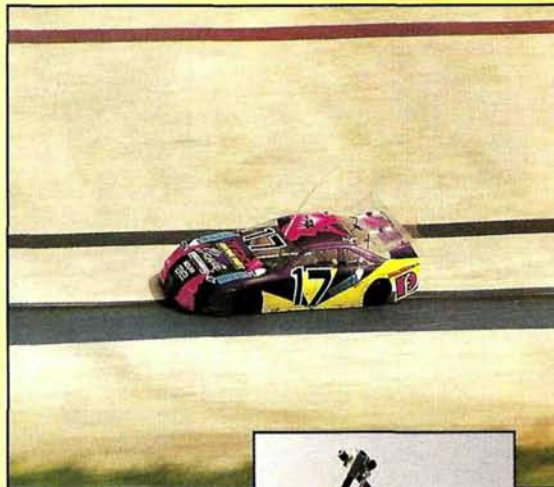
At last year's T-Drome, Kent Clausen shattered his previous record of 70.1mph by posting an average lap time of 75.96mph. Race fans speculated that if anyone was able to beat Clausen's record in '92, it would be by a slim margin. Hah! Little did they know what speeds would be attained on the new track in Carson.

During the warm-up runs, Clausen and Associated teammate Shawn Ireland looked unbeatable with their

PHOTO BY A.R. FLATBUSH



Lett's pitman makes a quick battery change and bids the car adios!



Daniel Kopald, a producer for Broadway Production Studios, was busy all weekend videotaping the racing action.

The R/C Thunderdrome, brought to you by *Radio Control Car Action* and Futaba, and organized by Dan Moynihan of Dan's R/C Products and Gary McAllister of McAllister Racing, is the fastest R/C-racing event in the world. Now in its fifth year, Thunderdrome attracts competitors from all over the globe and draws sponsorship from a wide variety of companies—Goodyear, Budget Rental Cars, Adohr Farms Dairy,

General Electric, Ramada Inns and Delta Airlines are just a few.

Associate Editor John Howell and I had never been to Thunderdrome, and on the plane ride from New York to Los Angeles, we discussed what we thought it would be like. I told him that it would be difficult to photograph the cars on the track, because even the stock cars travel

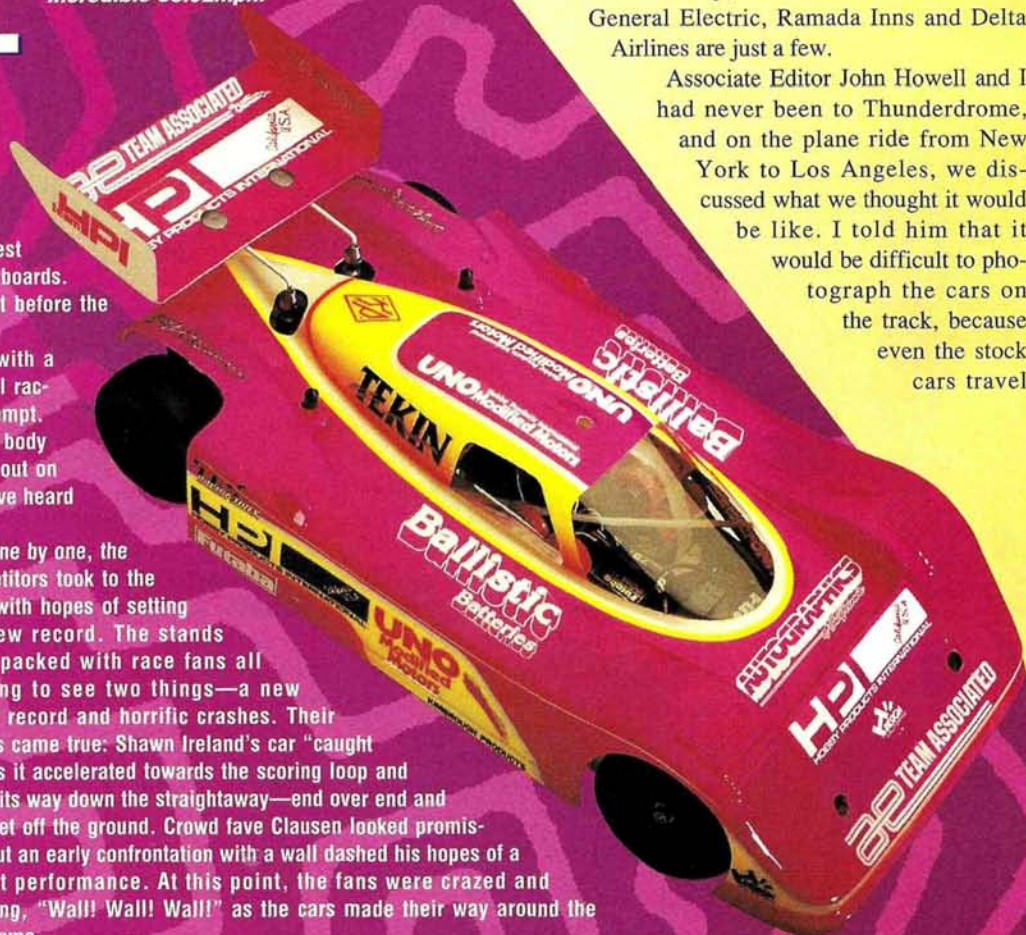
Insanity REIGNS SUPREME

prototype "pancake" cars. The bodies of their cars were so low that they sat atop the battery packs! On early trial runs, Ireland and Clausen broke the 80mph barrier!

Cliff Lett had an Insane Run entry, but it seemed that every time it hit the track for a test run, the radio glitched and sent his car into the boards. Cliff hoped to work the bugs (and splinters) out before the actual Insane Run.

The Custom Works team was out in force with a couple of their popular 4WD Dominator dirt-oval racers that had been converted for the speed attempt. They used a prototype of a Protoform Insane Run body that looked more like something that you'd see out on the Bonneville salt flats than at a banked oval. I've heard that this body will soon be produced.

Gary Hamilton's Insane Run-winning car. Gary used many HPI parts on this 10L hybrid. TRC radial tires and an HPI UNO modified motor carried this car to an incredible 85.02mph!



Saturday night was dubbed "Insane Night." One by one, the

competitors took to the track with hopes of setting the new record. The stands were packed with race fans all wishing to see two things—a new speed record and horrific crashes. Their wishes came true: Shawn Ireland's car "caught air" as it accelerated towards the scoring loop and made its way down the straightaway—end over end and two feet off the ground. Crowd fave Clausen looked promising, but an early confrontation with a wall dashed his hopes of a repeat performance. At this point, the fans were crazed and chanting, "Wall! Wall! Wall!" as the cars made their way around the velodrome.

The new record of 85.02mph was set by Team HPI's Gary Hamilton, followed by Lett and Joe MacGregor. The 1992 event was the largest ever, with more than 25 contestants—16 of whom went faster than last year's record! So what's it gonna be in '93? 100mph?

INSANE RUN RESULTS

1. Gary Hamilton85.02mph
2. Cliff Lett82.97mph
3. Joe MacGregor82.86mph
4. Sally Ham81.56mph
5. Roger Pane81.45mph
6. Craig Perry81.13mph
7. Mike Lavacot80.81mph
8. Nick Case80.08mph
9. Bob Novak79.37mph
10. Danny Egger79.06mph



Reggie Murphy of the Toyota Motorsports GTP team was instrumental in bringing the #99 car to the Thunderdrome. In '92, Toyota won both the drivers' and manufacturers' titles in IMSA GTP with drivers Juan Fangio Jr. and P.J. Jones.

at speeds over 50mph. Also, getting hit by an Insane Run car could break his ankle—or worse—so he had to be careful when he shot action from the track's infield. We just hired the guy; it would really stink if he was wasted by a careening 10L!

A quick ride from LAX to the car agency, and we were ready to pick up our rental steed. I had specified a convertible when making travel arrangements; I mean, we're in L.A., man! Besides, at the last two races I covered, I got stuck with the most stripped-down cars on the lot; we're talking cheap here.

We checked into our hotel on Thursday night, just around dusk. At the Ramada's front desk, a gentleman at my right was speaking to the person behind the desk, and I couldn't help overhearing their conversation. He and his son were in town for the Thunderdrome race, and he was asking for details about the Tekin "Power Breakfast" (a complimentary breakfast for the racers on Friday morning, provided by Kevin Orton of Tekin). What blew my mind was when he said that they had flown in from Turkey! Wow! *Car Action* really is everywhere. John and I decided not to look for the track until the morning. Besides, how hard could it be to locate a concrete bicycle-racing track?

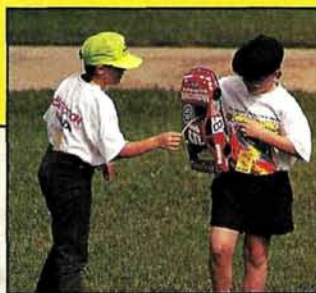
After a good night's sleep, and a quick breakfast of a burger and fries (trying to explain to the waiter that I was from the East Coast and my internal clock said it was lunchtime was a lot of fun), we were off in the "Pro-Stock" Sunbird to find the Thunderdrome.

John and I stayed at the Thunderdrome's host hotel, and most of the racers were leaving for the track as we

(Continued on page 47)

Superspeedway drivers

found it advantageous to use "callers" to warn them of traffic and accidents that lay ahead of them on the track. Also, the callers could inform the pitmen when a stop would be necessary.



One of the RACO 1/4-scale cars "blurs" down the straight during the exhibition race. The crowd loved the big, gas-powered cars.



RETHUNDERDROME®

1. Amateur drivers' covered pit space

2. Pro drivers' covered pit space

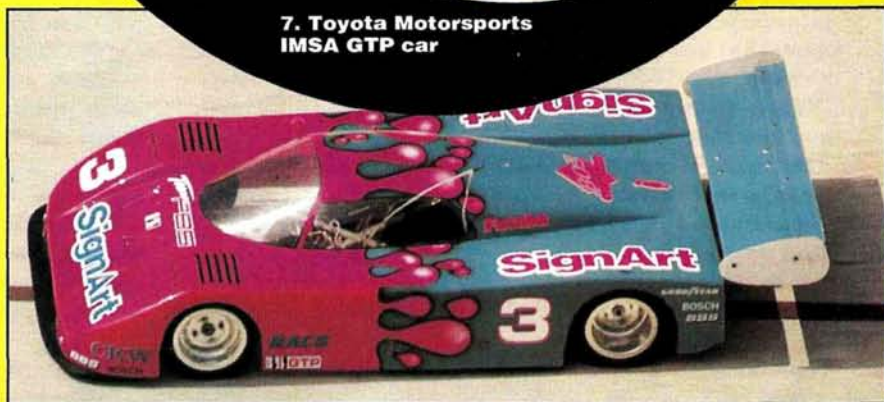
3. Victor Engineering charging stations

4. Covered tech inspection area

5. Announcers' /radio broadcast booth

6. Drivetech stock car display

7. Toyota Motorsports IMSA GTP car



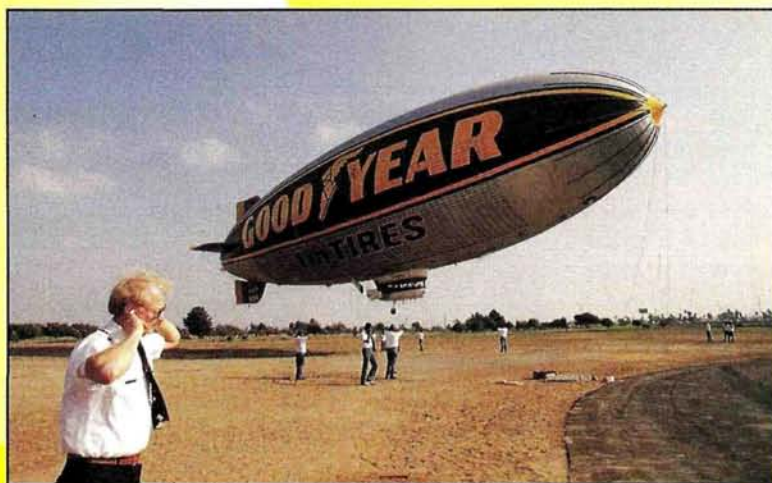
PHOTOS BY A.J. FLAUBUSH

THE SUBTLE HUM of the Goodyear

blimp's twin engines caught our attention as Frank and I walked the pits of the Thunderdrome. I looked at Frank and said, "Wouldn't it be cool if we could ride in that thing?" The next thing I knew, there was an announcement over the P.A. system: "Would

Frank and John from *Car Action* please report to the front gate." It was Banana Dan calling us to the front.

When we got there, Dan whisked us away from the



Hindenburg, is it?"

"Shut up and relax," Frank quipped.

After the pilot had brought the blimp in for a landing, we were set to go. I quickly looked for expressions of terror on the exiting passengers' faces. I was half expecting to see a person coming at me with this crazed look

yelling, "Don't do it man, just don't do it!"

We strapped ourselves in and prepared for takeoff.

The pilot looked old. I thought to myself, "Man,

OH THE HUMANITY! ANYWAY...

gathering crowd of our loyal fans, then dropped the bomb that we would be going up in the blimp in a few minutes.

"Hey, wait a minute," I thought to myself, "I was only kidding!"

So there we were, heading towards the Goodyear Airship Operations airfield to ride in the famous blimp. I was scared out of my mind, but Frank was as calm as could be.

"I don't know about this one, Frank," I said, "That thing goes pretty high. It's like riding in a minivan at over 3,000 feet."

"Relax," commented Frank. "It'll be fun."

"Yeah, right," I thought to myself, "I can't stand heights. I don't even like airplanes."

Then I saw it on the horizon.

"Man, that thing's huge!" exclaimed Frank

"Yeah, but the little caboose thing under it is pretty hurtin'. It's way too small. There's no way I'm going up in that thing. We'll run out of oxygen...the straps holding the thing on will snap, and we'll plummet to our death...something will happen and the blimp will float off into space...the doors will fly open, and I'll fall out...this thing's not like the

who's gonna fly this thing if he has a heart attack?"

"OK, guys, prepare for takeoff!" yelled the pilot.

"Here we go into the wild blue yonder, never to be seen again. Wasn't this on an episode of *Unsolved Mysteries*?" I asked myself.

The takeoff was brutal. It was worse than any roller-coaster ride I had ever experienced. You take off nearly vertical as all the hot air and helium are shifted toward the front of the blimp.

Once we leveled off, I released the death grip on my seat and looked out the window.

"Oh man, we're definitely up high," I thought to myself. "I guess I'd better start taking some pictures."

After a while, I began to feel more and more comfortable. I actually began to have a lot of fun. Frank and I started to joke around about the flight; then I concentrated on shooting more photos.

We were able to move around the cabin, so I moved up to the front to shoot a few photos of the pilot. Then he said those eight immortal words...

"Hey, do you want to fly this thing?" he asked.

I was a bit surprised at the question, and even more so at my answer.

"Sure," I said. "I'll give it a shot."

So there I was, in the captain's seat, with him taking pictures of me as I flew it. It's very easy to fly. At your feet are two pedals. To go left, you push down on the left pedal (to go right, push the right pedal). To control altitude, there's a wheel mounted on the side of the seat (it reminded me of a wheelchair setup)



RC THUNDERDROME®

that you push forward to go down and pull up to continue climbing. It's as simple as that. And yes, I was pretty freaked out to be flying the blimp, but I was totally stoked at the same time. I was really careful, though. Can you imagine if I shifted the blimp too quickly to one side and the captain fell out the door? What if he hit his head and was knocked unconscious? Instead of being on *Unsolved Mysteries*, we were now headed toward a bad Three Stooges rerun.

After I had my turn at the wheel, the pilot let Frank fly it, too. He had this crazy look on his face, and then he started to look around the freeways as if he

"He had a crazy look on his face."

were going to drop some altitude and buzz some cars. And no matter what anyone tells you, we did **not** drop any jawbreakers out the blimp windows at 3,300 feet.

When we landed, we were asked if we'd like to go up for another ride; the next party had cancelled and we could go if we wanted to. So did we go? Of course we did. But this time we had a different pilot, and he was a spode; he wouldn't let us fly it. And yes, we still deny the jawbreaker rumor! OK, well maybe one or two slipped out of my hands...it was an accident...really.

All in all, our blimp excursion was a total blast. I'd like to thank the good (no pun intended) people at the Goodyear Airship Operations airfield for the experience. It's one that we'll never forget.

were, so we simply followed them to the velodrome (it's always easy to spot an R/C racer's vehicle—it's the one stuffed to the gills with toolboxes, bodies, and empty food containers). As John eased the Sunbird into the dirt parking lot (well, E-braked is more the term), it began to sink in just how big the Thunderdrome was—and the parking lot was already packed with cars!

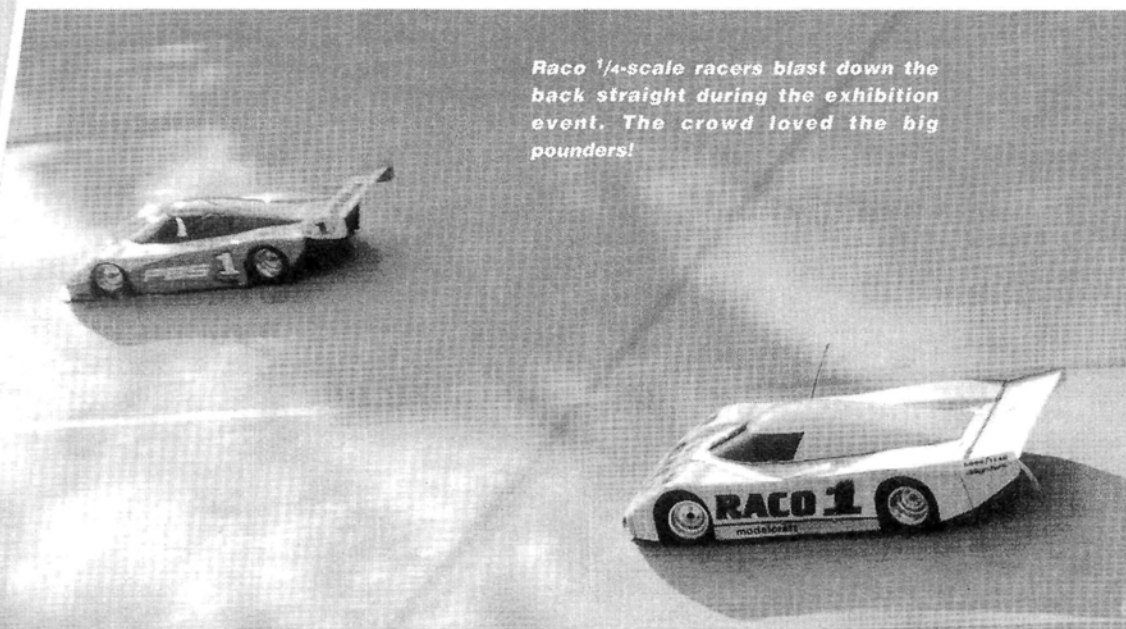
Once inside the gate, we set about finding the head honcho—Banana Dan, the Thunderdrome man—to get the lay of the land. He gave us our press passes (which would allow us unlimited access to all areas of the facility, except, of course, the ladies room) and gave us the grand tour.

HUGE NEW FACILITY

The CSU—Dominguez Hills Olympic Velodrome in Carson, CA, is, to the best of my knowledge, the largest in which an R/C race has been held. The concrete surface is glassy smooth—smoother than last year's track, the Encino Velodrome—and has a center line distance of approximately 1,250 feet. The turns are banked at 33 degrees, and the straights are banked at 10 degrees. Parking and pit space were in short supply last year, but at the new facility, which can easily handle up to 5,000 spectators, there's plenty of parking. Two massive tents sheltered the pit area, and racers could easily get down to the infield for tech inspection—without having to cross the track and risk dismemberment—by means of a tunnel that ran from the grandstand area to the track's infield. The new facility also had such amenities as a snack bar, bleachers on both sides of the track, and security provided by California State University campus police.



The Thunderdrome was promoted months in advance. One of the event's sponsors, Adohr Farms Dairy, printed the race information on its milk cartons.



Raco 1/4-scale racers blast down the back straight during the exhibition event. The crowd loved the big pounders!

RETHUNDERDROME®

THE BIG TOP

Dan took us through the large, covered pit areas. One of the two tents was strictly for the manufacturers and served as both a pit area for their drivers and as a display area for their products. This space was provided in return for the manufacturers' sponsorship. Anyone could stroll through this area and check out the latest "heavy hardware" and chat with some of the best-known R/C drivers in the world.

The following companies and company representatives were on hand to display their wares: Team Associated, (Cliff Lett, Kent Clausen, and Shawn Ireland); Bud's Racing Products (Bud Bartos); Hobby Products International (HPI); Progressive Technologies Inc. (PTI), with Ralph Burch Jr. and the Hyperdrive team; Jay and Chuck Kimbrough of Kimbrough Products; Carlos Turano of Cheetah Racing; Mike Walker of Twister Motors; Chris Farrell of C&M Team



A Drivetech Racing School stock car was on display. Here, Kyle Reed thinks seriously about entering the Pro Superspeedway class next year—Drivetech awarded free lessons to the winner!

Cobra; Bolink, with Rick Jordan; Dan's R/C Stuff (of course); Brian and Jerry Landgraff of Custom Works; Dave Pulfer of McAllister Racing; and Bob Novak of Novak Electronics. Also present were Composite Craft, CAM, East Coast Modifieds, Peak Performance, Sean Young of True-Turn, TMS Pro-

ducts, Fine Design, LAVco, Race Prep, A&L, Ballistic Batteries, Davis Motorsports, CKW, Saiko Racing, Team Smooth, Revtech, Victor Engineering, Tekin, Fine Art, BBR, TRC, Quarterflash, and Autographics (who supplied the realistic-looking number decals for the racers). Thanks to these companies for their support of the Thunderdrome race and the R/C hobby.

The second tent, as large as the first, was pit space for the non-factory drivers and was provided as part of the entry fee.

A-MAIN ACTION

● Pro Superspeedway

This was the biggie—150 laps of sheer speed and intensity.

After a slick start (the track had cooled after the qualifying rounds, and traction was minimal), Top Qualifier Ralph Burch Jr. took an early lead, followed by Bud Bartos in second and Cliff Lett in third.

The racers would have to come in for a pit stop about every 3½ minutes—so this race would be won not only on the track, but also in the pits.

Even at this early stage, many of the cars were having trouble with their capped tires; you could hear the telltale scraping sound of blown caps.

The top three drivers came in for their first pit stops of the race (around lap 13—3½ minutes, as predicted), but Bartos spun out coming back onto the track, and he lost his second-place spot to Mike Boylan. Boylan eventually succumbed to Lett's pressure on lap 26; he was forced to relinquish his position to the "Buggy Master."

The speeds were incredible. Race-leader Burch averaged laps of 64mph, while Associated driver Kent Clausen, who moved

steadily through the pack, turned in an average lap speed of 65.7mph.

As Boylan made a move on Lett to take back the second slot on lap 50, a problem involving his ESC sent Boylan's car over the pit wall for mechanical attention.

By lap 68, Lett, whose car was averaging 3mph faster than Burch's, had pulled up to the leader's bumper and, on turn three, he made a brilliant pass that put him into first.

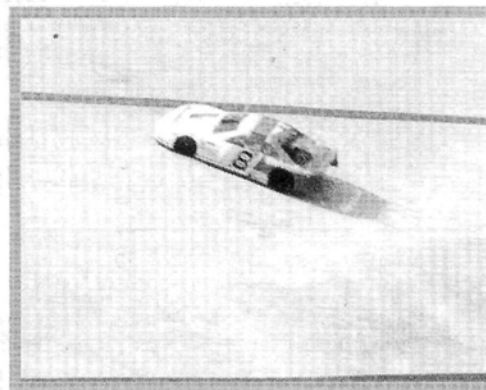
At this point, Burch's car had pulled into the pits for a motor change, which cost him precious time and effectively put him out of the race—or did it? Burch came out of the pits with a new motor and proceeded to blister the track, turning in an awesome average lap of 67.8mph! Could he catch Lett?

Burch's hopes were dashed on lap 94, as his car was taken back over the pit wall yet again; apparently, this time it was trouble with the capped tires.

At lap 100, Lett had a full lap advantage over the entire field, and he held it all the way to the full 150. Lett's teammate Clausen finished second, just one lap down from the leader. Team HPI's Gary Hamilton, who had won the Insane Speed Run the previous day, crossed the line with a well-deserved third.

Competition seems to bring innovation. To win in the Superspeedway class, quick battery changes are essential. Racers always try to outdo one another with trick, quick-change systems that will give them that precious, 1/10-second advantage.

Carlos Turano of Cheetah Racing, a pioneer of quick-change battery systems, uses a variation of his company's QC mechanism. The pack is first loaded into the chassis-mounted receptacle (like a rifle clip), where it mates with a set of contacts. The contacts connect the pack to the speed controller. When a



● Sportsman Stock

At the incredibly clean start of this four minute race, it was second-qualifier Larry Pipp out in front, followed by Top Qualifier Vic Nalley in second and Joe Wishon in third. Pipp set the track on fire as he turned in consistent 53mph laps—he ran at a pace that was more than 3 seconds faster than the TQ time for this class!

This was one of the closest races of the day; eight of the nine cars ran on the same lap, vying for position. At the finish line, it was Pipp with a 7-second lead over second place Wishon, who had taken advantage of

QUICK-CHANGE ARTISTS

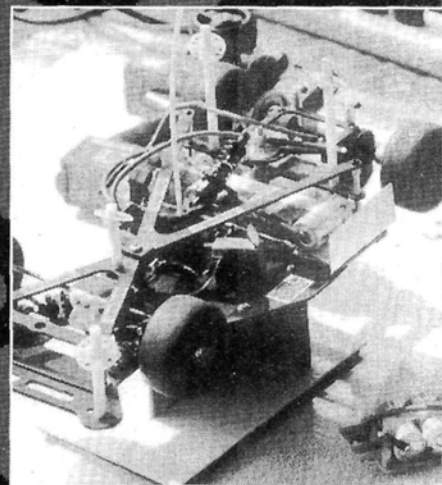
pack change is required, the body is depressed directly over an additional body post. The post, in turn, releases the pack, which literally "shoots" (via rubber band) out of the side of the car, allowing a fresh pack to be loaded.

The most "high-zoot" quick-change method has to be Roger Pane's. He uses a second servo (controlled by the third channel on his radio) as a release mechanism. When Roger made a pit stop, he would simply drive into the pit lane, wait for his pit person to pick up the car, and then activate the auxiliary servo by a switch mounted on his radio's steering wheel. The servo would release the pack into his pit person's hands, and a new pack could be slapped in.



Bolink's quick-change system.

Bolink's quick-change system is one of the most popular. Two inverted, Associated-style battery cups are attached to the car's chassis directly above an opening that's roughly the size of the battery pack. A sliding graphite "hatch" can be pulled back easily, allowing the pack to simply fall out. Copper braid—on the pack and inside the rear battery cup—connects the pack to the speed controller.



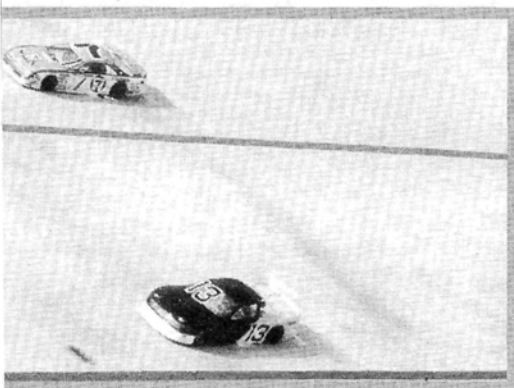
Cheetah's quick-change system on its Telesis car.

SIDESHOW ATTRACTIONS

The Thunderdrome is an extravaganza—not merely a race. During lulls in the racing action, there's always something to do and see.

Several booths were set up around the track's perimeter and, of course, there was the infamous *Car Action* booth/war zone. Several thousand magazines had been sent out to be given away to spectators.

Unfortunately, with John and I covering the action, there wasn't anybody manning the booth, and the kids went wild! When we could get back to the booth, it was always a shambles; there were kids throwing bundles of magazines over their heads in search of that newer issue they knew "just hadda be there." What a mess. Anyway, Dan Moynihan dispatched Danny Batinich (one of the Thunderdrome



Nalley's slowing car on the last lap and made a clean pass.

● Sportsman Modified

The Sportsman Modified class had some of the most entertaining racing of the event. The race started with top qualifier Dr. Todd Nalley pulling the holeshot, followed by Mike Skube and Jim Molnar.

While Dr. Nalley and Skube were going at it, Molnar sneaked past and took over the lead, and then Skube passed Nalley. Going into turn three, Nalley pulled a crowd-pleasing pass on Skube, but stayed too low going

into turn one, lost control of the car and spun into the grass, he dropped to seventh place.

So now the show was centered around Molnar and Skube. As the finish tone sounded, they both crossed the finish line, and they had to race another full lap to break the tie. With both of them dumping, Skube went high in the final turn and swooped down on Molnar, gathering just enough speed to win by a single car length! Following Molnar was Bryant Thomas in third, Victor Babani in fourth, and Mike Fleek in fifth.

● Expert Stock

As the tone sounded for the Expert Stock class, Top Qualifier Kurt Perham jumped out to an early lead. Following Perham was Jim Collins, who had qualified seventh. Tagging along in the third position was Rick Noel, then Chris Rowland, followed by Brett Patti in fifth.

It looked as if Kurt would have an easy race with his 2.4-second lead over the rest of the pack, when around the 3-minute mark he had trouble and hit the wall, letting Collins, Noel and a hard-charging Patti past him.

Mike Hughes, who started out in the last position, had moved all the way up to sixth place. By this time, Perham had recovered from his crash, but he was relegated to eighth

place. Collins took the overall win, followed by Noel, Patti, Bob Sarnelle, and Ed Allen.

● Expert Modified

Fifth-qualifier Scott Laid pulled the holeshot in the Expert Modified class, with Roy Powell on his rear bumper, followed by Craig Baxter. Not too long into the race, there was trouble in turn four, and Roy Powell took over first, with Baxter in second. Meanwhile, back in seventh place was the Top Qualifier Brian Bowler, who was making a hard charge toward the front of the pack.

Scott Laid had dropped from first to third owing to the trouble in turn four. In fourth was seventh qualifier Steve Lantz. Bowler was busy making up places in the back of the pack. Up front, Baxter had taken over the front-runner's spot on the back straightaway, while Bowler had taken third. The amazing thing was that Bowler had picked up four spots within two laps. Bowler took away second from Powell, and set his sights on Baxter.

With 30 seconds left in the race, Bowler took over the lead and held it to the finish. Baxter finished directly behind him with Powell, Hamilton and Laid rounding out the top five.

RETHUNDERDROME®

staff) to give us a hand with the booth.

Kyosho's booth featured some of their newest cars—like the 1/8-scale electric Williams Formula 1 car, and the Nitro T-Bird. General Electric had a booth in which Andy's R/C Products displayed its latest bodies (Andy's uses GE's Lexan in its bodies).

In addition to the hobby displays, there were full-size automotive attractions: Toyota Motorsports showed off its IMSA GTP car, and Driveteck Racing School had one of its stock cars trackside. Driveteck offered free racing lessons to the winner of the Pro Superspeedway class—what an incentive to go fast!



Will Handzel of Circle Track magazine was victorious once again in the Celebrity Race. Time for Will to enter the Pro class! What do you think? Will is shown with Miss Thunderdrome, Leisha Wojciechowski. The Celebrity Race cars were provided by Bolink.

THUNDER-STRUCK
This year's Thunderdrome proved to be the fastest one ever. With speeds at a fraction above 85-mph, what can we expect from next year's race? 90 to 95mph...what about 100mph? Who knows?

We were also impressed with the spectator turnout at this event. Many people wandered in to check out the biggest R/C race of the year, and they left with a new outlook on the R/C hobby. We hope that more and more people will become afflicted with the R/C fever that has captured us all.

Car Action thanks Dan Moynihan and Gary McAllister for putting all their efforts toward making this year's Thunderdrome the biggest and best ever. Congratulations to Cliff Lett and Gary Hamilton for their outstanding performances and to the other racers who went out there and gave it their all. It was an event to remember, and we can't wait to see what's in store for the Thunderdrome next year. ■

Johnny Williams (left), of Long Beach, CA, was the very happy winner of a set of full-size Goodyear tires.



SPORTSMAN STOCK

Fin	Qual	Name	Chassis
1	2	Larry Pipp	Associated 10L
2	5	Joe Wishon	Associated 10L
3	1	Vic Nalley	TRC Lynx SS
4	10	Chris Powell	TMS ST
5	6	John Crowley	CC 10L SS
6	7	Kenneth Bassett	Cheetah Agitator
7	8	Bill Beauchemin	Trinity ReFlex
8	9	Michael Sheehan	McAllister "OO"
9	4	Robert Picone	Hyperdrive Hyper 10
10	3	Gary Marques	Chapparral Racing

SPORTSMAN MODIFIED

Fin	Qual	Name	Chassis
1	5	Mike Skube	Cheetah Telesis
2	9	Jim Molnar	PB Sizzler
3	2	Bryant Thomas	CC/Bud's 10L SS
4	3	Victor Babani	n/a
5	7	Mike Fleck	TRC LTO
6	6	Bud Inkyo	CC Ground Effects
7	1	Todd Nalley	Associated 10L SS
8	8	Fred Medel	Associated/Cheetah 10L
DNS	4	David Fossen	C&M Cobra
DNS	10	Richard Dan	Associated 10L SS

EXPERT STOCK

Fin	Qual	Name	Chassis
1	7	Jim Collins	TRC Lynx II
2	2	Rick Noel	OM-10 Mid
3	4	Brett Patti	Associated 10L SS
4	6	Bob Sarnelle	C&M Cobra SS
5	3	Ed Allen	Trinity ReFlex 10
6	6	Jeff Knize	n/a
7	10	Mike Hughes	DA 10L SS
8	1	Kurt Perham	Associated 10L SS
9	5	Chris Rowland	McAllister
10	8	Chad Ragland	McAllister Rebel

EXPERT MODIFIED

Fin	Qual	Name	Chassis
1	1	Brian Bowler	HPI 10L
2	13	Craig Baxter	TMS 10L SS
3	4	Roy Powell	OM-10
4	3	Craig Hamilton	HPI 10L
5	5	Scott Laid	Associated 10L SS
6	7	Steve Lantz	Associated 10L SS
7	9	William Brown	Associated 10L SS
8	8	Steve Cervantes	HPI 10L
9	2	Eric Vasutin	Associated 10L SS
10	10	Kenneth Jones	Associated 10L SS
11	15	Michael Frey	Associated 10L SS
12	12	Leonard Lee	n/a
13	6	Pat McConaughy	CC Ground Effects
14	11	Darryl Reich	Bolink SS LTO
15	14	David Wert	Associated 10L SS

PRO SUPERSPEEDWAY

Fin	Qual	Name	Chassis
1	6	Cliff Lett	Associated
2	5	Kent Clausen	Associated/Bolink Conv.
3	13	Gary Hamilton	HPI
4	8	Shawn Ireland	Associated/Bolink Conv.
5	15	Ted McDonald	n/a
6	9	Craig Perry	Bolink
7	2	Craig Carey	Hyperdrive H1ORSQC
8	14	Derek Povah	C&M Cobra SS QC
9	20	Mike Garrett	Bolink
10	1	Ralph Burch Jr.	Hyperdrive H1ORSQC
11	19	Jamie Woosley	Hyperdrive H1ORS
12	10	Mike Lavocat	Associated
13	12	Roger Pane	TMS
14	4	Chris Smith	Hyperdrive
15	16	Dave Puffer	McAllister
16	7	Bud Bartos	Hyperdrive
17	18	Danny Egger	Associated 10L
18	3	Mike Boylan	Associated
19	11	Rich Hohwart	Bolink
20	17	Bob Carlos	Associated/CC 10L

*CC = Composite Craft



Motor	ESC	Radio	Batteries	Charger	Body	Tires
R	Tekin 411G	Futaba	Stealth 1400s	Victor	Protoform	CKW
A	Novak M5	Futaba	1400 SCR	Novak	Pro-Line	TRC
C H	Tekin 411G	Futaba	Max-Cell 1700	Tekin	Protoform	TRC
E A	Tekin 411G	Futaba	Stealth 1400	Tekin	Protoform	CKW
N	Tekin	Futaba	1700 SCRC	Victor	Protoform	TRC
P D	Tekin 410K	Airtronics	Stealth	Comp. Elec	Olds	TRC
R	Tekin 411G	Futaba	Trinity Pushed	Comp. Elec	Bolink	TRC
E O	Tekin 420F	Airtronics	Ballistic SCR	Tekin	McAllister	TRC
P U	Tekin 420F	Futaba	Stealth	Tekin	Protoform	Pro-Line
T	Tekin	Futaba	World Class	Tekin	PSE	TRC

Motor	ESC	Radio	Batteries	Charger	Body	Tires
Extreme	Tekin 411F	JR Propo	Stealth	Novak	Associated	CKW
East Coast	Tekin 411G	Futaba	Top Gun	Tekin	Bolink	T/M
BC Special	Tekin 411P	Airtronics	Perfect Match	Comp. Elec	BBR	TRC
n/a	n/a	n/a	n/a	n/a	n/a	n/a
Reedy Mr. X	Novak M1c	Airtronics	Team Smooth	Tekin	Bolink	TRC
CAM	Tekin 410K	Futaba	CAM	Victor	Bolink	TRC
Twister	Tekin 420F	Futaba	Max-Cell	Victor	Protoform	TRC
Revtech	Novak MXc	Futaba	Revtech	Comp. Elec	Associated	TRC
Fantom	Tekin 411G	Futaba	Panasonic	Comp. Elec	Bolink	TRC
Ballistic	Tekin 411P	Futaba	Ballistic	Tekin	Bolink	TRC

Motor	ESC	Radio	Batteries	Charger	Body	Tires	Sponsors
R	Tekin 411G	Futaba	Stealth	Victor	Protoform	TRC	Allen Racing Products, Stealth Batteries, Saiko Racing
A	Tekin 411P	KO Propo	Stealth	Comp. Elec	Protoform	TRC	Stealth Batteries, Precision Motorworks, Tekin, DMS, RCRC
C H	Tekin 420	Futaba	Ballistic	Tekin	Protoform	TRC	
E A	Tekin 411P	Futaba	Stealth	Comp. Elec	Protoform	TRC	Victory Speedway
N	Tekin	Futaba	Trinity Pushed	Victor	Protoform	TRC	Allen Racing Products
P D	n/a	n/a	n/a	n/a	n/a	n/a	
R	Novak M1c	Futaba	Team Smooth	Novak	Bolink	TRC	Team Smooth, Frank's Hobby House, Cannon Motors, Bad Dog, Top Gun
E O	Novak	Airtronics	Stealth	Novak	Protoform	TRC	Stealth Batteries, Davis Motor Sports, Precision Motorworks, Chequered Flag Raceway
P U	Tekin	Futaba	Ballistic	Tekin	McAllister	TRC	McAllister Racing, Dan's RC Stuff, Cannon Motors
T	Tekin 410	Futaba	Ballistic	Tekin	McAllister	TRC	McAllister Racing, Dan's RC Stuff

Motor	ESC	Radio	Batteries	Charger	Body	Tires	Sponsors
HPI Uno	Tekin 420	Futaba	Ballistic	Tekin	Bolink	TRC	HPI, Uno Modified, Tekin, Ballistic Batteries, Kimbrough, TRC
RPI	Tekin 411G	Futaba	Stage III	Tekin	McAllister	TRC	Team Thundercars
Extreme	Novak MXc	Airtronics	Max-Cell	Novak	Bolink	TRC	Extreme Motorsports, HPI
HPI Uno	Tekin 411G	Futaba	Ballistic	Tekin	Bolink	TRC	HPI, Ballistic Batteries, Tekin, Kimbrough, TRC
Bud's	Novak	Futaba	Max-Cell	Novak	Bolink	TRC	Bud's, Max-Cell, Du-Mor, JACO
HPI Uno	Tekin	Airtronics	Ballistic	Comp. Elec	Bolink	TRC	HPI, Ballistic Batteries
Factory	Novak	KO Propo	Kinetic	Tekin	BBR	TRC	BBR, Factory Horsepower
HPI Uno	Tekin 411P	Futaba	Ballistic	Tekin	Bolink	TRC	HPI, Ballistic Batteries
Ironman	Tekin 411G	Futaba	Stealth	Comp. Elec	Bolink	TRC	Ironman Motors, S&K Racing, J&M Hobbies, Tecnacraft, Fast Fashion, Stealth Batteries
Factory	Novak	Futaba	Kinetic	Tekin	BBR	TRC	BBR, Kinetic Industries, Factory Horsepower
Revtech	Tekin 411P	Futaba	Trinity Pushed	Comp. Elec	Protoform	Bolink	Revtech, Trinity
n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Tactical	Novak MXc	Airtronics	Tactical	Comp. Elec	Bolink	TRC	Tactical Racing, Sheldon's Hobbies, Davis Motor Sports
Quarterflash	Tekin 420F	Airtronics	Quarterflash	Victor	Bolink	Bolink	Quarterflash, Tekin, Airtronics, Victor, Bolink
Bud's	Novak	Futaba	Voodoo	Novak	Bolink	TRC	Voodoo Racing Cells, HPI, Bud's, Scat, Keystone Hobby, Lavco, JT's Hobby House

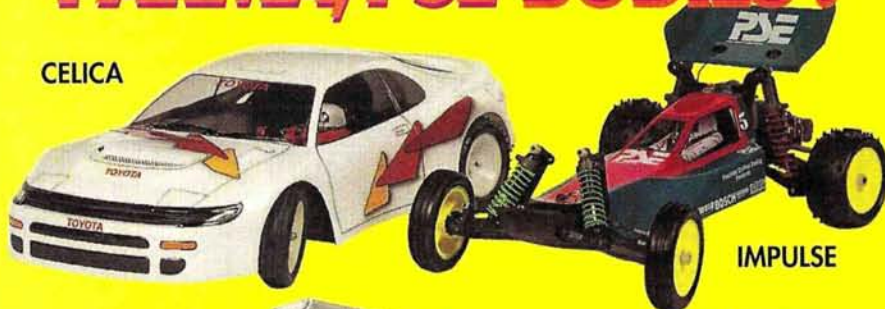
Motor	ESC	Radio	Batteries	Charger	Body	Tires	Sponsors
Reedy	Novak Hpc	Airtronics	Reedy	Novak	Associated	TRC	Associated/Reedy, Novak, RCPS, Oakley
Reedy	Novak	Futaba	Reedy	Novak	Associated	TRC	Associated/Reedy, Lavco USA, Novak, Bud's, TRC, Futaba
HPI Uno	n/a	Futaba	Ballistic	n/a	Bolink	TRC	
Reedy	Novak	Futaba	Reedy	Novak	Associated	TRC	Associated/Reedy, Lavco USA, Novak, Bud's, TRC, Futaba
Race Prep	n/a	Futaba	Stealth	n/a	Andy's	TRC	
East Coast	n/a	Futaba	n/a	n/a	Bolink	Bolink	
CAM	Tekin 411G	Futaba	PTI	Tekin	Protoform	TRC	CAM, Hyperdrive, PTI, Protoform, Du-Mor R/C
Precision	Novak MXc	Futaba	Stealth	Victor	Protoform	CKW	Davis Motor Sports
Revtech	n/a	Futaba	n/a	n/a	Bolink	Bolink	
CAM	Tekin 411G	Futaba	PTI	Tekin	Protoform	TRC	Hyperdrive, PTI, CAM, Futaba, Tekin, Tecnacraft, Du-Mor, Bud's, Protoform, Autographics
Revtech	Novak	Futaba	Morton	Victor	Protoform	Bolink	Revtech, Autodrome Raceway
Reedy	n/a	Futaba	Morton	n/a	Hyperdrive	TRC	
Reedy	n/a	Futaba	Reedy	n/a	McAllister	TRC	
East Coast	n/a	Futaba	PTI	n/a	Bolink	TRC	
Fantom	n/a	JR Propo	n/a	n/a	McAllister	Twinn K	
Bud's	Novak M5	Futaba	Power Push	Novak	Bolink	TRC	Bud's Racing Products, Power Push Batteries, Novak
Twister	Novak	Futaba	Stealth	Tekin	Bolink	TRC	Twister, Stealth Batteries, Novak, Saiko, Composite Craft
Twister	n/a	Futaba	Team Smooth	n/a	Protoform	TRC	
Peak Perf	Novak HPC	Futaba	Team Orion	Novak	Bolink	Bolink	Peak Performance, Bolink, Futaba, Novak, Kimbrough, Team Orion
California	Tekin 411G	Airtronics	Panasonics	Comp. Elec	BBR Lumina	TRC	BBR Scale Racing Products, California Motor Works



The Thunderdrome scoring staff—(from left) Amy McGarvey, Mark Worthen and J.R. Sitman (NORRCA President)—confer with race organizer, Gary McAllister.

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VICTOR 1Q-FLEX

(Continued from page 24)

burped. It comes on fairly regularly, and that led me to believe that the burping was only timed, not regulated. Wrong! By placing a voltmeter across the pack, I found that the duration of the burp and the interval between the burps aren't uniform at all. In other words, this charger does exactly what it's supposed to do.

On the right side of the front panel are the start button and the cell-count slide switch. Simply depress the start button to get things rolling; the charge LED comes on a few seconds later. The cell-count slide switch allows you to tell the IQ-Flex how many cells are being charged (from three to 10). How about that! You can charge a 10-cell pack! This will require a higher input voltage from your power supply (usually only 12 to 13.8 volts). The IQ-Flex will allow up to a 20V input.

Only four wires exit the IQ-Flex: two for power-supply input and two for output to the battery pack. On the back of the IQ-Flex, you can install a mini muffin fan to help to cool the charger (this should only be necessary when you charge fewer than six cells at high amperage).

A "reflex" charger charges for a spell and then backs off—kinda like taking three steps forward and two steps back. As I mentioned before, the IQ-Flex operates differently. Although there's a load placed against the pack during charging, it doesn't knock down the pack's voltage. Try to picture it this way: it's like stuffing your garbage can full of trash, stomping on the trash and then stuffing it again. This charger just keeps stuffing power in the pack.

FLEXING YOUR MUSCLE

To test the IQ-Flex, I charged some 1200, 1400 and 1700mAh Sanyo SCR packs with a very reliable charger, and I recorded how long it took to discharge each of them on a 10A load. I let the packs sit for at least 48 hours and then charged them on the IQ-Flex and discharged them with the same 10A load. In every case, the packs had a larger capacity—some only by a few seconds, others up to 7 percent more. In a 4-minute race, that could mean 16 seconds of run time. Hey, I'll take that any day of the week!

The only way to monitor the charge is to place a voltmeter on the pack while the charge is under way. Also, the charger's microprocessor is very sensitive. How sensitive? If the position of the cell-count slide switch is "off" a little, the "fault" LED will

(Continued on page 62)



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VICTOR 1Q-FLEX

(Continued from page 58)

light up and the charge will stop. Don't look at it as a hindrance; the microprocessor is trying to get everything right. At least you don't have to worry about blowing anything up. In any case, the circuitry is internally fuse-protected, so it isn't likely that you'll destroy this charger!

Overall, this charger rates high on my list of worthy equipment. It does everything its manufacturer's press release says it will do, and it's smart enough not to harm the battery pack or itself. The rugged case should keep it safe from the elements and ensure a long life. I believe this is a "keeper."

*Here's the address of the company featured in this article:

Victor Engineering, 1000 Calle Cordillera, San Clemente, CA 92673; (714) 366-2931. ■

SUPER SPORT '93

(Continued from page 33)

the depth of the threaded part of the clutch nut and marked the shaft accordingly. Shorten the crankshaft by cutting it with a hacksaw, but be sure to cut straight and to clean the cut end afterward with a file.

BODY BEAUTIFUL

I sent the Super Sport '93's polycarbonate body and wing off to our newest "lacquer slinger," Todd Kerby of TK Designs*. Todd really went off the deep end with this job; it's a combination of jagged edges on one side of the body, and liquid "drips" on the other side. Todd's airbrush artistry is quite impressive; don't you agree?

When it's time to trim the body, remember that the engine's heat-sink head must receive plenty of cooling air. (You may have to remove part of the windshield to ensure adequate cooling.)

HITTIN' THE TRACK

With the engine thoroughly broken-in (see sidebar), I fueled up and headed to the Queens Off-Roaders indoor track in New York. Owner John Lee lets gas cars run there when the regular 1/10-scale electrics aren't racing.

I tested my Super Sport '93 when I knew that some of the Team Mugen guys would be at the track, because I wanted to pick their brains for set-up tips. Sure enough, both Mugen's Chester P. and J.D. Beckwith (who drives electrics for Team Associated and Reedy Motors, and is the current ROAR 4WD National Champion) were there practicing with their Mugens.

After a few slow laps to get used to the layout, I started to squeeze the trigger and really let loose the horsepower! Even on a track

(Continued on page 76)

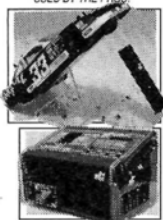
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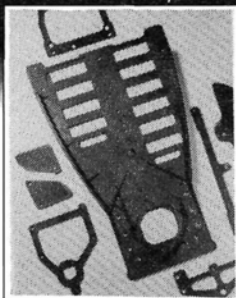
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We're not talking about your Aunt Ethel's new Betty Crocker mixing bowls, or Uncle Fred's new electric sheep clippers. We're talkin' R/C goodies, folks.

Wake up! Pay attention, snapperheads!

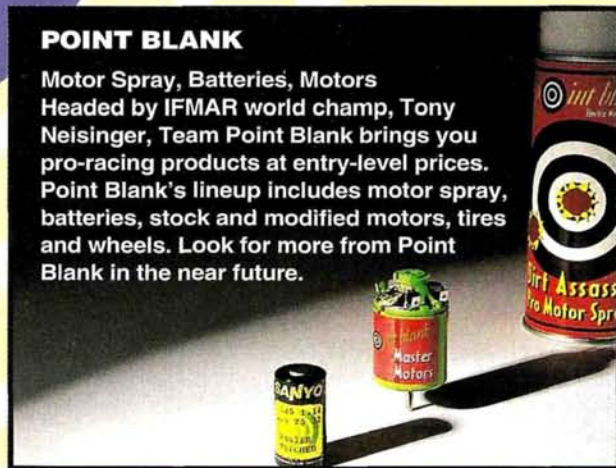
We have all the latest hi-zoot, ultra-trick gadgets. And they're the

hottest new products in 1993. So rock it out and check your cash flow to see which

you can't live without.

POINT BLANK

Motor Spray, Batteries, Motors
Headed by IFMAR world champ, Tony Neisinger, Team Point Blank brings you pro-racing products at entry-level prices. Point Blank's lineup includes motor spray, batteries, stock and modified motors, tires and wheels. Look for more from Point Blank in the near future.



PRO-LINE NASCAR BODIES

Pro-Line offers a few new light polycarbonate NASCAR bodies that are already pounding the pavement in a stylish fashion. New bodies include the Narrow Pontiac Stock Car (part no. 3069); the Narrow Lumina Stock Car (no. 3038); the Narrow T-Bird Stock Car (no. 3037; with Bud decals, no. 3052). There are also wide versions: the Wide Lumina Stock Car (no. 3044); the Wide Pontiac Stock Car (no. 3042); the Wide T-Bird Stock Car (no. 3043); and the Wide T-Bird with Bud decals. If you want one of these bodies, take \$19.95 out of your wallet—\$29.95, if you want one with Bud decals. So check 'em out!



New for '93

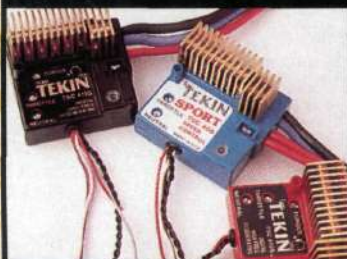


TAMIYA AMERICA SUPER BLACKFOOT

The all-new Super Blackfoot features a die-cast, metal, bevel-gear differential, front and rear double-wishbone independent suspension, longer suspension arms, a wider wheelbase and ultra-strong dog-bones. Its center-mounted servo-saver ensures that the tie rods are the same length for consistent handling in rough turns. The kit comes with a mechanical speed controller and a reliable 540 motor—\$179.95.

TEKIN UPGRADED ESCS

Tekin has updated its popular 411G speed controller and slightly revamped its other popular controllers.



They all now have a thicker, more durable circuit board, heavier wires (more power) and an economical solder-drop fuse that protects against reverse-voltage damage without losing power. For low "on" resistance, the 411G

uses Tekin's premium Goldfet transistors, and it has extremely smooth proportional throttle control and fully adjustable brakes. It also uses Tekin's regenerating and recharging circuitry.

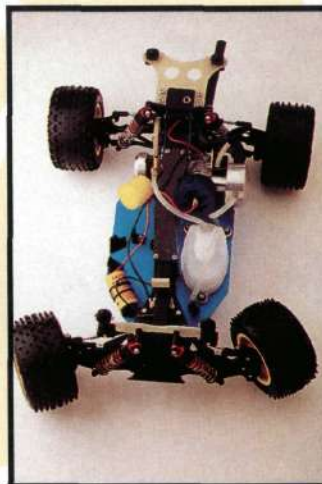


FUTABA 2V ATTACK III

This new system sets the standard for all entry-level, two-stick radios. It comes with 20KHz, narrow-band signal spacing and a sound/LED low-battery alarm. Designed to be comfortable to use, the non-slip control sticks offer positive control. A five-LED early-warning system monitors and displays the condition of the batteries, and a beeper signals when the batteries should be replaced. The radio comes with the new R112JE 2-channel narrow-band receiver and two S-148 precision servos.

DURATRAX GAS CONVERSIONS

First seen at the '92 Kyosho Gas Challenge, these DuraTrax conversion kits for the RC10T and LX-T caught the attention of spectators and racers. The kits allow you to convert your 10T or LX-T into a gas truck. All the kits have: a heavy-duty gearbox; a tough chain-drive system; a black-anodized aluminum chassis; a rear shock tower; a fuel tank and tubing; all the hardware; instructions. Buy the kit with or without a .12 CZ-R engine. The prices?—LX-T with CZ-R: \$299.99; without CZ-R: \$199.99; 10T with CZ-R: \$279.99; without CZ-R: \$179.99.



SCHUMACHER NITRO 4X4

One of the hottest items we saw at the Chicago show was the new 4WD gas truck from Schumacher. Powered by a 28,000rpm .15 Irvine engine, the Nitro 4x4 has two ball diffs that are driven by a Kevlar belt. Schumacher's telescopic drive shafts take the power to the front and rear wheels, and a unique, onboard glow igniter ensures quick, easy starting. Just add fuel, prime the tank, hit the starter button, pull the ripcord and you're off. The Nitro 4x4 is extremely light, and with its powerful .15 engine, it's ultra-fast. It comes assembled (without radio gear) and costs \$849.95.

PARMA/PSE PSE PRO EAGLES

After testing them thoroughly at this year's Thunderdrome, PSE introduced its new cap tires at the RCHTA show. The new PSE Pro Eagles cap tires are available in three compounds: Red Dot, Gold Dot and Silver Dot and nine tire combinations. They have a radial seam, so they're more truly concentric than other tires. Pro Eagles will be available in three staggers and will be sold at one low price of \$19.95.



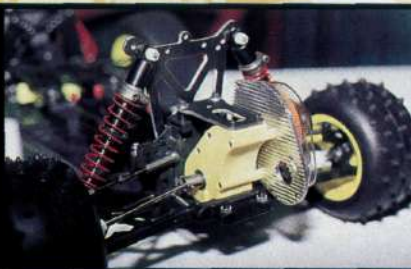
PARMA/PSE LAZER ZX-R TOMCAT BODY

Check out this hot new Parma body for the Kyosho Lazer

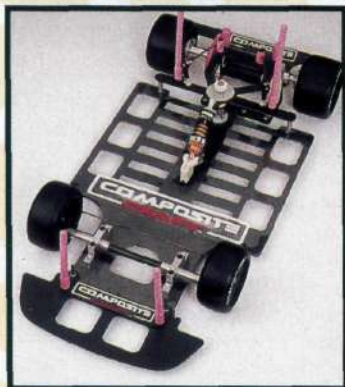
ZX-R. Labeled the "Tomcat," this sleek, aerodynamic, Lexan body comes complete with a wing and retails for \$15.

A&L MFG. **LX-T LETHAL WEAPON 2**

Here's the new Lethal Weapon 2 kit for the Team Losi LX-T. The kit includes a pair of specially designed dogbones made of high-grade stainless steel. They transform the LX-T's axles into universals that are the same length as the LX-T's rear-suspension arms. A&L's Power Clutch slipper is included—and all for \$117.



ADC/COMPOSITE CRAFT **10LSS GROUND EFFECTS KIT**



This kit contains all a serious racer needs to convert a 10L or a stock 10LSS into Ground Effects. You get the Ground Effects chassis, front and rear chassis braces, a bumper with a bracket, a nerf wing set, a Ground Effects bottom plate, a T-bar spacer, a sway-bar top plate, a .074-inch-thick fiberglass T-bar, a .078-inch-thick sway-bar kit, and a stock, aluminum, stand-off kit—all for \$129.95!

NOVAK **HPC SPEED CONTROLLER**

This is Novak's top-of-the-line controller. Its HyperFET transistors offer low resistance and adjustable current limiting, and its 2500Hz, high-frequency, pulse-width modulation allows more efficient battery charging while on partial throttle. The HPC's solid-state reverse-voltage protection protects it without using a fuse.

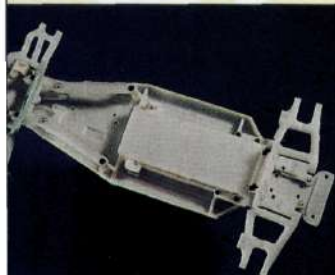
PEAK PERFORMANCE **SAINT MOTOR**

Peak Performance's new Saint 14-turn quad modified motor is based on an HPI can and endbell setup. It uses 4.95 wet magnets and has a hand-wound armature. All hand-wound Peak Performance motors have their armatures epoxied with a high-temperature resin, and that guarantees that the windings don't move. Each motor is assembled by hand and then checked on a dynamometer to ensure maximum power. Rick Vehlow TQ'd at the '92 ROAR Truck Nats with a Saint motor, which retails for \$80.



TRAXXAS **NITRO HAWK**

The 1/10-scale, gas-powered Traxxas Nitro Hawk comes fully assembled. Add fuel, fire-up the glow plug, pull the recoil starter, and you're runnin'. It has a heavy-duty T-6 aluminum-tub chassis, a .12 engine, a heavy-duty tranny, a high-volume air filter and a centrifugal clutch that's coupled to an adjustable slipper clutch. It also has Blue Eagle LS suspension components. It's trick!



RPM **MOLDED RC10 CHASSIS**

This light RPM chassis for the RC10 is made of durable plastic. It has RPM's Worlds front and rear suspension, nylon steering bellcranks, a top battery cover and all the necessary mounting hardware.

BOCA BEARINGS **SECRET WEAPON**

Secret Weapon—Boca's newest bearings—have extra-close tolerances and light plastic shields. They run on a truer path at higher rpm, and that makes you go faster down the final stretch. Secret Weapon costs slightly more than standard bearings, but if you want an advantage, it's just what you need to blow away the competition. Retail prices range from \$34.95 to \$36.95.



KO PROPO **EX-10**

New from KO Propo, the EX-10 radio has all the features that any racing FM radio could offer. Check it out! It offers PPM or PCM operation, fail-safe warnings (no one can mess up your settings), throttle and steering trim alarm, and enough memory to store settings for up to six cars or trucks. The features are all controlled by a keypad on the base. If you're in the market for a new FM radio, check out KO's EX-10.



New for '93

AIRTRONICS RIVAL 2P



This pistol-grip radio system is an advanced, AM, narrow-band system that includes steering dual rate, LED power monitor, low-battery alarm, completely retractable antenna with a protective cover, servo-reversing, throttle-trigger guide, and mini-receiver with built-in BEC. The RV2P will be available with two 94102 standard servos and will also be offered with one 94102 servo and a 96315 Contender speed controller. In March, it will be available in 27MHz, and in April, 75MHz.

Retail price: \$139.95 (\$199.95 with the ESC).



ADC/COMPOSITE CRAFT LX-T GRAPHITE CHASSIS

Talk about trick items! This ADC/Composite Craft LX-T graphite Double Decker composite chassis is definitely hot. The double-decker design dramatically stiffens the chassis so it's less likely to twist or buckle. This means that you'll have the consistency you need to "dial-in" to a particular track. The guys at ADC/Composite Craft say the lightness of this chassis and its slightly modified shape allow faster cornering. Double Decker chassis is available for a multitude of other vehicles and retails for \$101.95.



SCHUMACHER PEAK CHARGER

For extra punch and consistency from your cells, this Schumacher peak-charger has a low-frequency, soft-pulse system. It's controlled by a temperature-stable microcomputer that ensures a reliable charge every time. Choose the type of charge you want—soft start to full charge; a low-current start will detect reversed and shorted cells and help you to avoid doing further damage. It will also trickle-charge after fast-charging has ended. Most important, if the peak voltage isn't detected, its safety timer will shut it down and prevent it from damaging the Ni-Cds. Its price?—\$129.95.



MRC WORLD SCALE

MRC's rugged World Scale trucks and buggies are great. They have: adjustable ball diff with slipper clutch; Power Command transmissions; 4-wheel independent suspension; four oil-filled aluminum shocks with coil-over springs; seven ball bearings; a 30-degree front-end rake angle for high-speed stability; aluminum chassis; two 540 motors. One-tenth-scale buggies and trucks look small in comparison. When World Scale trucks and buggies hit the track, they demand attention!



TRINITY EVOLUTION 10

It's finally here! The car that Joel Johnson used to capture the world title can now be yours. The Trinity Evolution 10 has an extremely rigid, narrow, graphite-plate chassis that takes the battery right down the middle. In the front, there's the unique "caster reactive" front suspension, and in the rear, three, Delta-type, oil-filled, coil-over shocks.

MUGEN USA RACE TEAM

At this year's RCHTA show, Mugen USA proudly displayed its new, 1/8-scale Super Sport '93 buggy and its 1/8-scale Toyota racing truck. Shown here are Mugen USA president, Lori Greenberg, and her sidekick and team manager, Chester P. The company also announced its intention to form a high-zoot racing team that will compete on the



fast-growing gas-racing circuit this year. Some of the country's hottest drivers are rumored to be heading the new Team Mugen. Stay tuned for more details.



A&L MFG. ROADKILL KIT

Hey oval freaks! Transform your RC10T or LX-T into an oval truck! As we go to press, the 10T kit comes with two pairs of green-dot, low-profile, mounted and trued front and rear foam tires; rear wheel nuts; all the necessary hardware; a clear Lexan body; a flat piece of Lexan and instructions on making a side dam; and a new, short, rear shock tower (requires RC10 short front shocks, which aren't included). It also includes set-up instructions and how-to tips on lowering your vehicle for oval racing. The 10T kit costs \$56.85. The LX-T kit is still in the works. A custom-painted Roadkill body is \$49; a clear one is \$17.75.

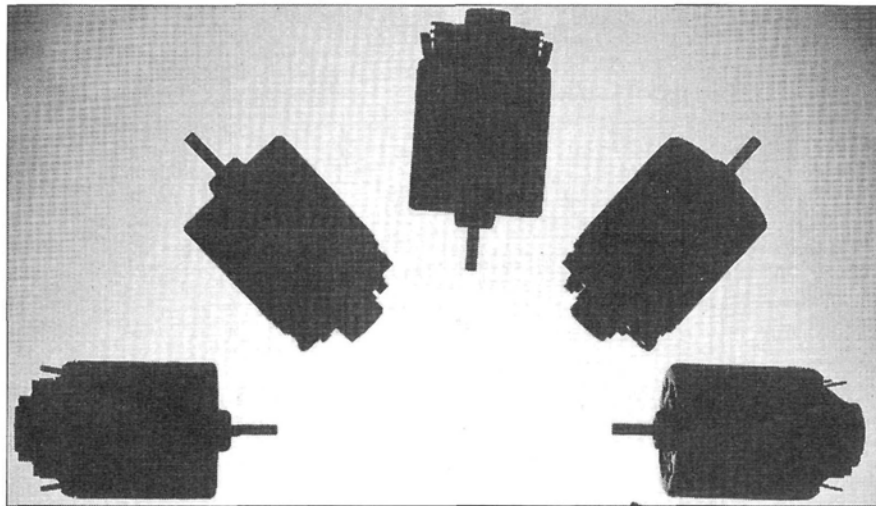


RCM/SERPENT 1/8-SCALE EXCEL

Berton introduced the new Serpent 1/8-scale 4WD Excel on-road car in Chicago. Its features include a 2-speed transmission, quick-change front and rear wheels, a rear-suspension body-mounting system and fully adjustable ball-type pivot points. Its new, stiff, composite-nylon suspension parts are very resistant to impact. The Serpent Excel (part no. 9000) will cost you 750 big ones.

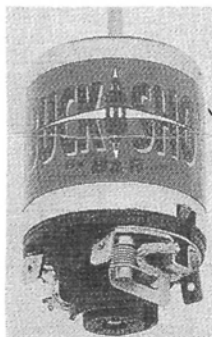
MOTOR
TECH
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STOCK MOTOR BUYERS' GUIDE



Stockin' it to ya!

Short stacks, split-rotor slotted armatures, 4.9 wet magnets, 6, 10, 24 and 34 degrees of timing, 27-turn singles, 15- and 18-turn doubles.... We're talking stock motors. You want 'em; we've got 'em—the hottest and newest of 1993...35 of the most trick stock motors...right here...in this issue...on the next few pages...go ahead; look...we're not lying...it's all there...trust us. Best of all, every one retails for \$28. So if you're in the market for a new stock motor, take a peek.



B&R MOTORWORKS Signature Series Stock Motors

These motors use the latest in slotted-armature technology, and they come in two versions: a 24-degree ROAR '91 (Buckshot) and a 34-degree pro-stock (Pro Stock Signature). Both versions have Epic 4.9 wet-magnet cans, upgraded silver graphite brushes and specially tuned B&R springs. To ensure maximum speed and reliability, B&R breaks them in and then dyno-tests them.

Part nos. 1013 (Buckshot); 1031 (Pro-Stock Signature).



C&M MFG./TEAM COBRA Team Cobra Stock Racing Motors

In an attempt to make these the fastest ROAR-legal motors, C&M has replaced the stock brushes with high-quality graphite, copper and silver brushes; replaced the stock springs with Team Cobra special-design springs; dyno-tested every unit; and aligned the hoods. These competitive stock motors are available in both on-road and off-road versions, and there's also the 24-degree 1991 Venom 24.

Part nos. 1125 (on-road); 1126 (off-road); 1127 (24-degree).



DURATRAX Outlaw Stock Motor

If you run on a track that doesn't insist on ROAR-legal motors, try the NORRCA-legal Powerline Outlaw Stock motor. It has 27 turns of 22-gauge wire, and its 36-degree timing and short-stack armature give it speeds no ROAR-legal motor can reach.

Part no. DTXC3210

MOTOR TECH SPECIAL



DURATRAX Powerline Slot Mania Motor

Now even the most cost-conscious competitor in stock-class racing can put slotted motor power in his corner. Designed for all-out speed and cooler, more efficient operation, the new Slot Mania is great value. Its slotted armature produces faster speeds and greater torque than standard stock motors, and its 24-degree timing makes it ROAR-legal and ready for any challenge.

Part no. DTXC3200



EXTREME MOTORSPORTS The Megatonic

Every Megatonic is hand-tuned by "Doc" Erik Soderquist. His years of experience are poured into each pink Epic-based motor, and so is the latest in brush, spring and magnet technology. With its 36-degree short stack, this motor is crushing records all over the country.

Part no. 4020



EXTREME MOTORSPORTS The Obliterator

This motor features the same technological breakthroughs as the Megatonic, but they're stuffed into a ROAR-legal package.

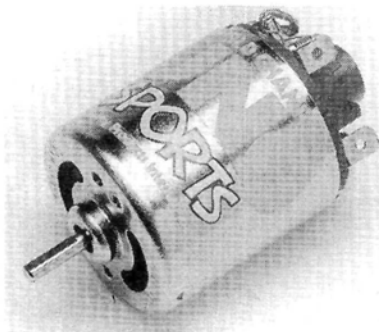
Part no. 2420



EXTREME MOTORSPORTS Bruno Max

Here's the Obliterator's full-stack big brother—the Bruno Max. It has the same basic can and armature, but 12 degrees more timing. This gives it many more power-packed rpm and substantially higher speeds.

Part no. 4040



HPI Uno Sports Motor

Try this! It has steel bushings, 10-degree fixed timing and a pair of 4.9 high-torque wet magnets. Fifteen-turn and 18-turn doubles are available.

Part nos. 1010 (Sports 15);
1015 (Sports 18).



HPI Monster Truck Stock 24 Motor

This bolt-on, high-performance, monster-truck stock motor comes with a pair of push-in-type Tamiya connectors and capacitors. Install it in most Tamiya and Kyosho trucks—Blackfoot, King Cab, Monster Beetle, etc.—without soldering!

Part no. 1200



KYOSHO ROAR 24-degree Stock Motor

Kyosho's stock motor meets all ROAR requirements for stock motors: 24-degree timing (the hottest timing allowed), a fixed endbell and 27 turns of .65mm wire. It includes wet magnets for more torque, a heat-sink endbell and the necessary capacitors.

Part no. KYOC2024



MOTOR MAN Speed Master

This is one of the fastest ROAR-legal stock motors, and it's perfect for ovals and long straights. Its slotted armature gives it awesome power and top speeds, and it comes with capacitors.

Part no. MMSMSPEED



PARAGON RACING PRODUCTS
Pro Stock Motor

Each ROAR-legal (27 turns; 24 degrees) Pro Stock motor, and they're all built to last.

Part no. 10000



PARMA
Cyclone ROAR Stock

This ROAR-legal 27-turn single features dry magnets, 6 degrees of timing and no commutator lock.

Part no. 14100



PARMA
Cyclone II ROAR Stock

The 27-turn single Cyclone II is ROAR-'91 legal and features a new wet-magnet design, a commutator lock and 24 degrees of timing.

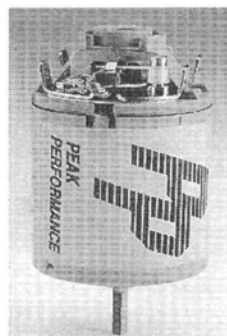
Part no. 14101



PARMA
Cyclone II Stock Plus

This 27-turn single outlaw stock motor has a new wet-magnet design and 40 degrees of timing.

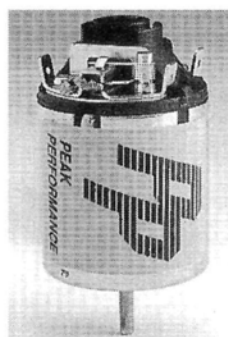
Part no. 14103



PEAK PERFORMANCE
Son of Psycho

Power and speed! Along with its awesome 36 degrees of timing, the Son of Psycho features a slotted, short-stack armature and a pair of team-tested soft racing brushes.

Part no. PP-12



PEAK PERFORMANCE
Macho Stock

Owing to its new slotted armature, the Macho Stock performs as well as stock motors with higher timing, but it offers longer run times and is more durable. It has all the trick components you need to put you in the winners' circle, including high-strength wet magnets, a heat-sink endbell, 24 degrees of timing and high-performance racing brushes.

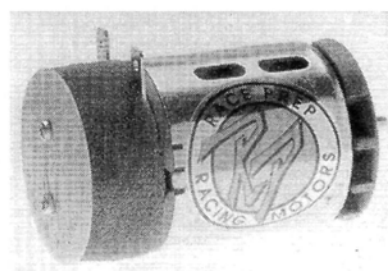
Part no. PP-11



QUARTER FLASH MOTORS INC.
Big D's Express

This outlaw stock motor with its all-new, slotted, short-stack armature offers 36 degrees of timing. The fluorescent-pink can contains 4.9 wet magnets and a heat-sink endbell with 401 Ultra silver brushes to provide good rpm and torque for off-road and oval racing. To ensure superior performance, all motors are tested on the new CEI Turbodyno.

Part no. 213



RACE PREP
Airtime

After a year of development by Mike Dunn, Race Prep's new line of stock motors is finally here. This 24-degree NORRCA- and ROAR '91-legal stock racing motor features the new NSR (narrow split rotor) armature design and powerful 4.95 wet magnets. It comes with Race Prep silver "R" and Stage 2 FTC (Fine-Tune Concept) compound motor brushes. Each motor is tested on the Turbodyno, and the dyno reading is included with the motor.

Part no. RP-24

MOTOR TECH SPECIAL



RACE PREP 38 Special

Do you want 38 degrees of timing in a motor that's built to NORRCA and ROAR '90 specifications and tested on a Turbodyno? This one has all the latest features—NSR armature design and Stage 2 FTC—and it's packaged with up-to-date gear-ratio suggestions from Team Race Prep.

Part no. RP-38



REEDY MODIFIEDS New Concept '93

This stock motor will have a new can, new magnet and new armature. Watch for it.

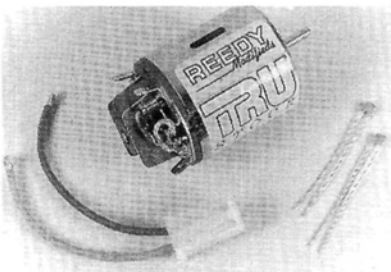


REEDY MODIFIEDS Super Outlaw Stock Motor

Based on the popular Outlaw stock motor, this new version has 38 degrees of timing and uses an armature configuration that was developed to take advantage of the increased magnetic field of wet magnets. Primarily for on-road racing and

2WD off-road, it was developed to give more rpm while running as efficiently as the standard Outlaw. The Super Outlaw isn't meant to take the place of the Mr. Outlaw, but it might be a good choice for you, depending on the type of racing you do.

Part no. 553



REEDY MODIFIEDS Super Tru-Stock Motor

This motor has the same specifications as the Super Outlaw, but it includes a commutator locking device and has 22- to 24-degree timing to comply with ROAR's stock-motor specs. It was submitted to ROAR for approval, and it passed.

Part no. 552



S&K RACING PRODUCTS Ironman ROAR '91 Greyhound Stock

This motor is for long tracks, and its brush/spring combination is one of the best. It comes with three sets of springs and two sets of brushes and caps. Right out of the package, the Greyhound is ready to race.

Part no. IM1040



S&K RACING PRODUCTS Ironman ROAR '91 Stock

The Ironman was developed for short tracks. Its unique brush/spring combination provides the

most torque possible. It comes with the brushes soldered to the can, three sets of springs, two sets of brushes and caps. So go racing!

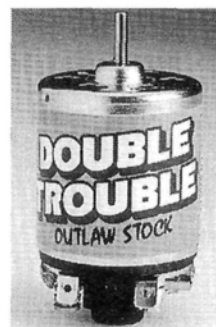
Part no. IM1010



SPEEDWORKS Joel Johnson Stock Part 2

Trinity's most popular stock motor is faster than ever. The second coming of the Johnson Stock features a new split-rotor slotted armature that decreases internal resistance and ensures higher revs and more power. With 45-degree timing, it's one of the fastest stock motors around. It has 4.9 wet magnets and 27 turns.

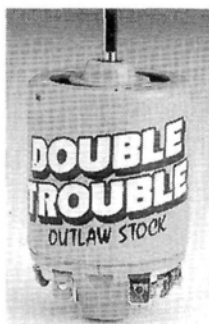
Part no. 0450



TEAM LOSI INC. Double Trouble Racing Motor

The high-performance, 45-degree (NORRCA-legal) Double Trouble Outlaw uses the latest stock-motor technology. Its unique, double-rotor armature rides in a thick, precision-formed can with the strongest, most heat-resistant, wet-pressed magnets available. High torque, unbelievable rpm and reliable performance!

Part no. TL-6026



TEAM LOSI INC.
Double Trouble
Short-Stack Stock

It isn't ROAR-legal, but it's one of the hottest stock motors available. With its short-stack armature, super-strong wet-pressed magnets, precision-aligned super-conductive brushes and whopping 36 degrees of timing, the hot-pink Double Trouble puts out good torque and exceptional rpm.

Part no. A-6027



TEAM LOSI
Super Insane
ROAR Stock Motor

The new, slotted-rotor-design Super Insane stocker uses the latest, strongest 4.9 wet magnets, precision-formed can and, of course, a slotted armature. Timing is locked at 24 degrees (the maximum under '91 ROAR rules). This motor produces as much power and rpm as motors with higher timing, but it runs more coolly and more reliably. Let Team Losi give your stock racer Super Insane horsepower.

Part no. 6024



TRINITY PRODUCTS
Green Machine

This 27-turn, short-stack stock motor meets ROAR and NORRCA requirements. A new

re design allows the use of less wire: a new winding pattern puts the wire closer to the core and produces higher revs and more torque. It has 5.0 wet magnets, 24-degree timing and a commutator lock.

Part no. 9224



TRINITY PRODUCTS
Slot Machine

Trinity has pulled out all the stops to produce a stock motor that not only meets ROAR's requirements but can also outperform motors with substantially more timing. With its patented slotted armature and tamper-proof commutator lock, the Slot Machine is sure to be seen at the track.

Part no. RC 2024



TRINITY PRODUCTS
Monster Stock Jr.

This one has an endbell with 4.9 wet magnets and a short-stack slotted armature in a fluorescent-pink can. The short stack lowers the motor's resistance and makes it faster than a standard stock. The timing has been set at 36 degrees.

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TWISTER MOTORS
Pink Stock Motor

This new motor comes in three versions: Twister Pink (804), Pocket Rocket (3000) and Signature



Series (3500)—all developed to be among the fastest stock motors. Their super performance comes from a slotted, short-stack armature and a wet-magnet can that together deliver high torque and high top-end revs.



VANTAGE ENGINEERING
Banshee 24-Degree

This ROAR-legal, split-armature motor is given a low-voltage break-in and then dyno-tested before it leaves the factory. It comes with details of amp draw, rpm and power, and this information, when used with the supplied "Inch Gear" charts, will help you find the best gearing for maximum performance.

Part no. BM024



VANTAGE ENGINEERING
Banshee 36-Degree

The new Banshee has the split-armature design of the Banshee 24 and a shortened armature stack. It has lower resistance than any other stock, 27-turn 36 degrees, so it's one of the fastest stockers available.

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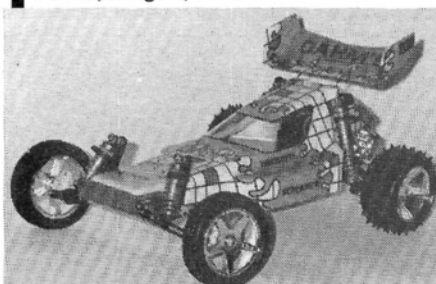
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SUPER SPORT '93

(Continued from page 62)

designed for the smaller electric buggies, the Mugen puts down the ponies (mostly owing to its sophisticated drive system and suspension).

The few electric racers who were there quickly gathered trackside when they heard the gas cars crank up down the straight. I'm not sure how our lap times would have compared to those of the electrics, but I think we were pretty close, if not faster.

One-eighth-scale buggies are just fast and can really get "air time." In one jump, J.D. cleared a set of five jumps that the 1/10-scale cars take three jumps to clear! (Well, most of the time, he landed on his wheels.)

I went to the track to tune my car, but I didn't change a thing. I was having too much fun to pull it off the track to make changes. Besides, my initial setup seemed pretty good, and my Mugen "hung" with Chester and J.D.'s cars. I plan to spend time on playing with the brake bias, because the car has a tendency to "wash out" when the brakes are applied. I probably need to take out some front brake to give the rears more authority.

All too soon, John Lee said playtime was over because he had to "Rototill" the track to prepare for the next night's races. Oh, well....

(Continued on page 87)

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by RUPERT MAYUGA

RESTORE STOCK MOTORS



*Build a budget
comm grinder*

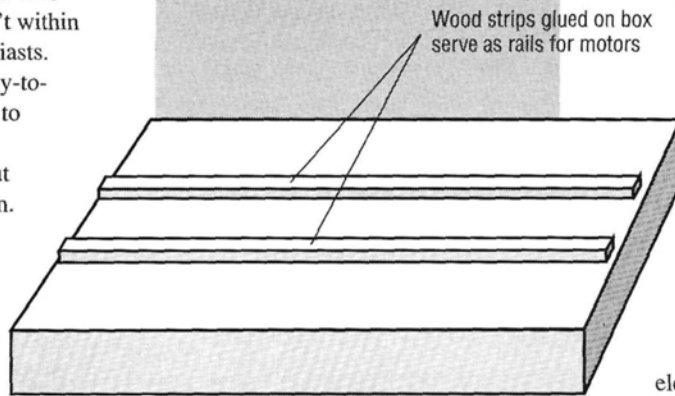
ARE YOU TIRED of throwing away stock motors after their commutators have worn out? Several manufacturers now make lathes that allow comms to be cut *inside* the motor can. Unfortunately, these lathes aren't within the budgets of many R/C enthusiasts. Well, here's an inexpensive, easy-to-build device that will allow you to grind and polish the comm and restore its performance—without taking the armature out of its can.

WHAT YOU'LL NEED

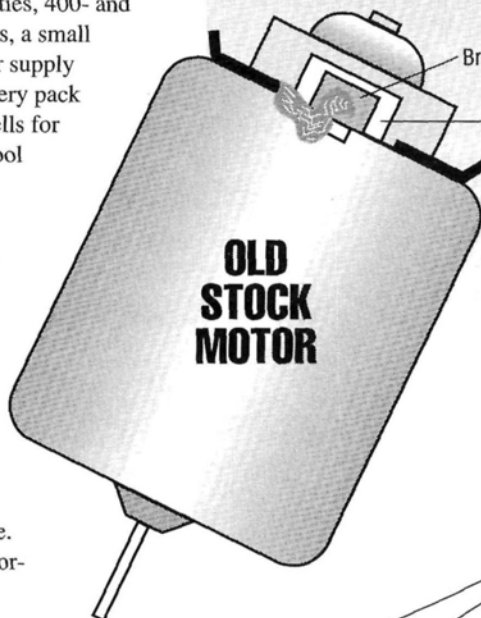
Gather the materials that you'll need: an 05-type motor to serve as a drive motor, a wooden or plastic rectangular "project box" (approximately 9x5x3 inches), two strips of wood ($\frac{1}{2}$ x $\frac{1}{2}$ x10 inches), CA or epoxy, silicone adhesive, rubber bands or wire ties, 400- and 600-grit sandpaper, scissors, a small hobby saw and a 6V power supply or a 3- to 6-cell Ni-Cd battery pack (3 cells for lesser rpm, 6 cells for a higher rpm). A Dremel tool will also come in handy.

ASSEMBLING THE MOTOR-MOUNTING PLATFORM

Cut the wood strips to the same length as the project box and lay them on top so that they serve as "rails" on which the motors can rest. Mark their positions, and then glue them in place. You now have a basic motor-mounting platform.



Wood strips glued on box serve as rails for motors



Brush hood

Insert sanding strip here (and out the opposite side)

**OLD
STOCK
MOTOR**

Rough side of sanding strip should face commutator

MOUNTING THE MOTORS

Center the motors (the drive motor and the stock motor that's being restored) on the rails and position their drive shafts so that they face each other.

If you want this to be a temporary setup, secure the drive motor to the platform with rubber bands or wire ties. For a permanent setup, glue the drive motor to the rails with silicone adhesive or epoxy. Temporarily secure the stock motor to the rails with rubber bands or wire ties. If you use wire ties, you'll need to bore holes (with a Dremel tool or an electric drill) in the box on each side of the wooden rails and insert the wire tie through them and around the motor.

Remove the springs and take the brushes out of the stock motor. Join the two motors with an inline shaft-coupling device such as Hobby Lobby's*

Graupner $\frac{1}{8}$ inch-universal joint (GR3543). Whichever coupling device you use, make sure that it has setscrews to lock the shafts securely.

GRINDING/POLISHING THE COMM

Cut strips of 400- and 600-grit sandpaper to a width that will allow you to thread them through the openings in the motor's endbell and around the commutator. The strips should be about 4 inches long. The 400-grit sanding strips are useful in the initial grinding, particularly of badly worn comms. The 600-grit

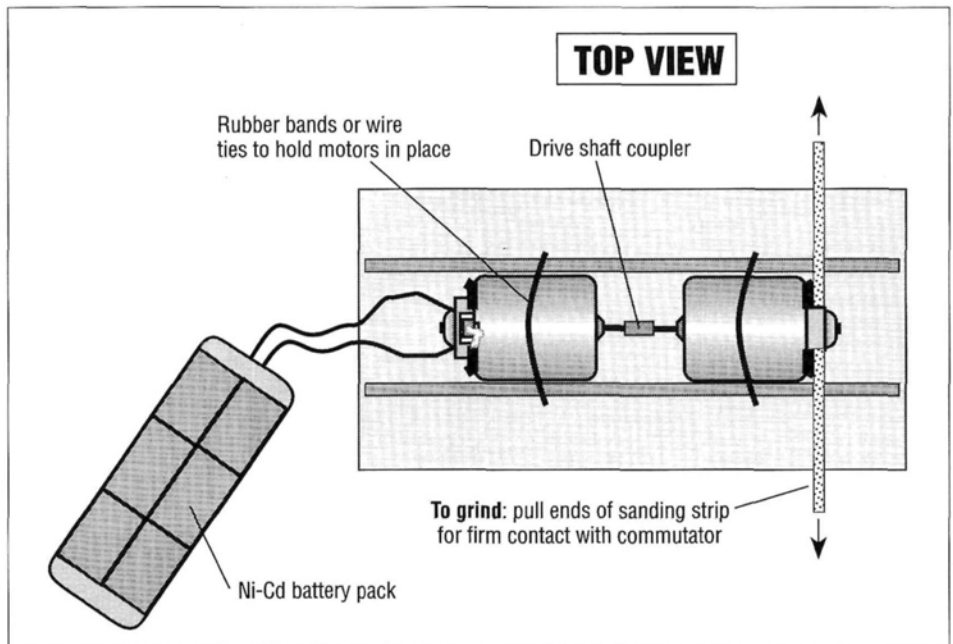
RESTORE STOCK MOTORS

strips are great when the comm isn't too badly worn or for "polishing" right after using the 400-grit strip.

Next, insert one end of a sanding strip (rough surface facing the comm) into the opening at the side of the brush hood, and push it out of the opposite side until equal lengths of the strip stick out from each side of the endbell.

Hook up the drive motor to the power source, firmly grasp the ends of the sanding strip (one end in each hand) and pull each end gently. This will provide firm contact between the sanding surface and the commutator, which will be rotating at a moderately high speed. To prevent uneven grinding, hold the sanding strip even with the commutator. Grind the comm for short periods (about 3 to 5 seconds) and inspect it frequently. This will ensure that you grind off only enough material to remove the uneven, burned and pitted portions of the worn-out commutator.

After grinding, flush the motor with motor spray or rubbing alcohol to remove all the fine debris. Remember to lubricate the bushings after cleaning the motor with solvents.



AN OUNCE OF PREVENTION

At this point, you will have restored most of your stock motor's "lost" performance (and saved some money, too). To maximize performance, be sure to replace old brushes, preferably with the type recommended by the manufacturer. Remember: an ounce of prevention is worth a pound of cure. Always

clean the motor after each use. Replace used brushes regularly and break-in new brushes properly—before they damage the comm.

*Here's the address of the manufacturer mentioned in this article:
Hobby Lobby, 5614 Franklin Pike Cir., Brentwood, TN 37027.

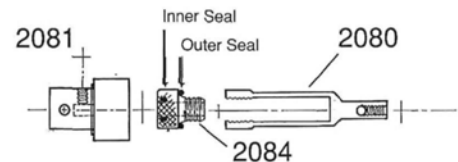
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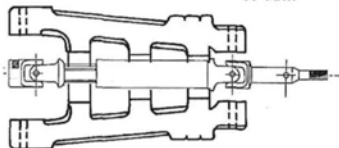


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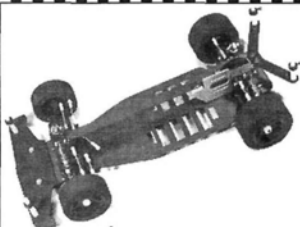
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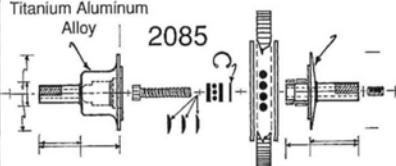


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Mike Bell and Team Riverside
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SUPER SPORT '93

(Continued from page 76)

CLOSING THOUGHTS

The gauntlet has been thrown down!

Kyosho's Inferno has stolen the World Championship title from Mugen, but who knows what will happen in the U.S. in '93? Mugen USA, the importer of the Super Sport '93, is really making an effort to turn up the heat on U.S. gas racing. With all the work Kyosho has done to popularize gas racing, I'm sure we'll see 1/8-scale gas tracks sprouting all over the country.

Overall, the kit is of good quality, and the parts fit together very well. The instructions could use some beefing-up, especially the written parts. (I found myself wondering whether any English-speaking person ever checked the translation.)

The Super Sport was a good car, but the '93 is way above it when it comes to performance and "tuneability." If you'd like to get into gas

(Continued on page 126)



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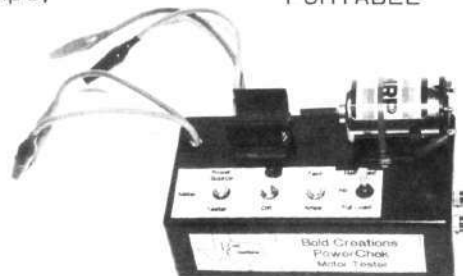
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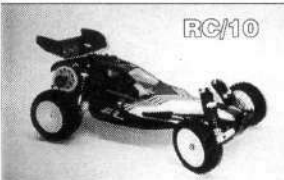
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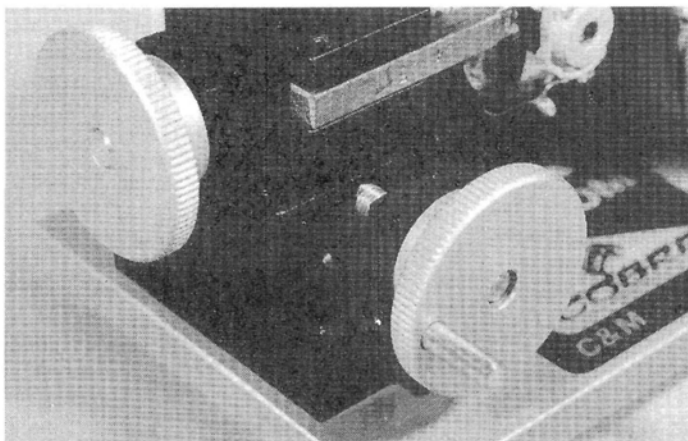
STOCK COMM LATHE

by
MIKE LEE

THERE HAVE always been two groups of stock-class R/C drivers: those who are fast, and those who scratch their heads and wonder why their motors are so slow.

To be considered stock, a motor's endbell must be fixed to its can so its timing isn't adjustable, and the commutator can't be re-trued. Or can it? The C&M* Team Cobra Stock

Comm Lathe can cut the commutator while it's *in* the motor can! Cutting and truing the commutator gives the average stock motor much longer life and maintains its peak performance.



Precise, metered dials control the cutting tool's movement, which is silky smooth because it rides on Teflon guides.

COMM DOWN

The Cobra Stock Comm Lathe is made of bar-stock steel and aluminum, and it's precise enough to cut to a tolerance of 0.0002 inch. The lathe has a fully adjustable tool-post carriage and cross-slide carriage. Each can provide a movement of .001 inch, although on the cross-slide, this isn't a critical consideration. It has dial calibrations for precise measurement.

The Stock Comm lathe comes with a carbide-tipped

N MOTOR LIFE

cutting tool that enters through the sides of the endbell to reach the comm—something that can't be done with a standard bit. And although the carbide tip works well, an optional diamond-tipped cutting tool provides a superb finish and is easier on the comm. [Editor's note: *Cobra recommends that lathe owners stick with the carbide tip until they're familiar with the lathe's operation.*] Also included are two motor pulleys, an O-ring drive belt, rubber feet for the base, a detailed instruction booklet and extra brush-spring posts for Epic motors.

COMM BEFORE THE STORM

To set up the unit, you'll need a drive motor (any 05/540-type motor will do). Insert the motor you plan to cut into the lathe, tighten it down, and put the cutting tool in the tool holder. Because of the lathe's precise tolerances, you might have to remove the label from the motor to avoid making a misaligned cut. Remove the brush hoods to allow the cutting tool to reach the comm. With Yokomo motors, you can remove one screw and swing the hoods out of the way. Because Epic motors' hood-mounting posts are so tightly attached to the endbell, you'll have to pull them out. The lathe kit provides two extra brush-spring posts with threaded tips; these replace the older brush-spring posts.

When everything is in place, it's time to cut. The result should be a like-new—or even better than new—comm. The motor's angle is important; an incorrect angle will prevent the tool from reaching the comm. To facilitate cutting, add a little oil to the comm. When the tool is positioned, slip the O-ring

onto the pulleys and turn the drive motor on.

Make the cut as you would with any other comm-cutting lathe. The only difference here is that the comm is still in the can. By all means, wear safety glasses! Copper chips from the comm will fly out of the endbell.

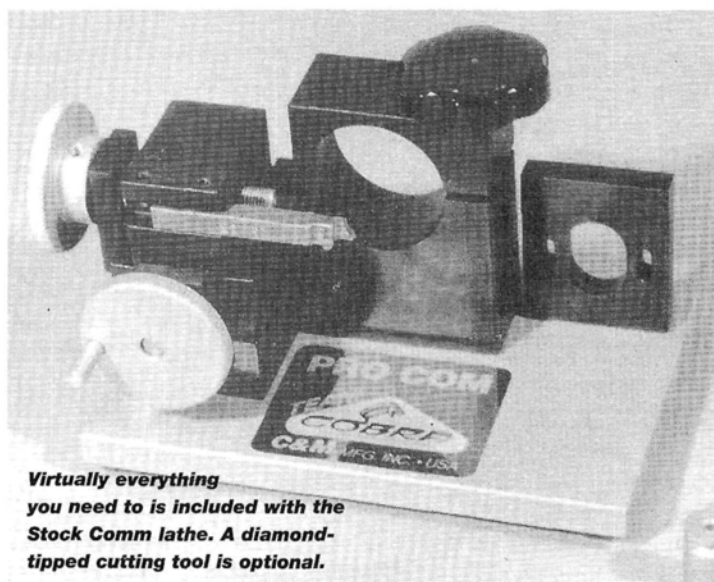
I experimented with the first motor to make sure that I had the technique down. The next motor was the test piece. I tested it on my Tekin* dyno after six runs. The rpm figure was 17,790, the power reading was 71, and the amp draw was 6.37. I cleaned up the motor, changed brushes and dyno-tested it again. The rpm figure was now 18,250, with a power reading of 72 and an amp draw of 5.81. Finally, I made a cut on the comm (I actually had to make four cuts to make it smooth and uniform) and then retested. Dyno-test readings showed an increase in rpm to 20,765, a power reading of 74 and an amp draw of 5.25. This represents a 13 percent increase in rpm, better efficiency and less power draw. Believe me, 13 percent more rpm on the track makes the difference between stock-class racing and fast stock-class racing.

COMM-CUTTING TIPS

As I cut, I found that it helped to have a flashlight so I could look into the endbell and ensure

proper cutting alignment. It takes about 10 minutes to cut a comm. That includes removing the brush hoods and any capacitors that are in the way, cutting the comm, and reassembling everything. If 10 minutes is all it takes to save a \$28 investment in a motor, then it's worthwhile indeed.

The Team Cobra Stock



Virtually everything you need to is included with the Stock Comm lathe. A diamond-tipped cutting tool is optional.

Comm Lathe is a very effective tool that performs exactly as advertised. The instructions will guide even a first-time user to a successful cut. Its Teflon guides also make it one of the smoothest I've used. The unit is nicely finished, and it should provide many years of reliable service. The best thing, however, about this lathe is that it's far cheaper than any other. What a deal! Check it out soon, and begin a new winning career in the stock class. You won't be behind in power any longer!

"The best thing, however, about this lathe is that it's far cheaper than any other. What a deal!"

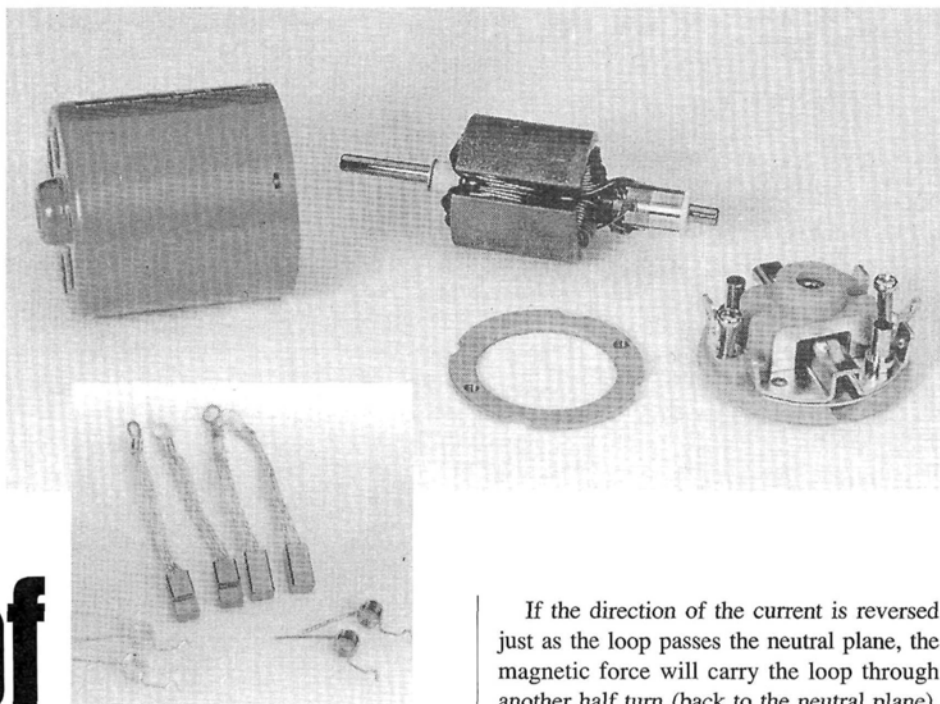
* Here are the addresses of the companies mentioned in this article:
C&M Mfg., P.O. Box 701-353, Nest Valley City, UT 84170.
Tekin Electronics, 970 Calle Negocio, San Clemente, CA 92672.



by STAN VanDRUFF

Basics of Electric Motors

MOTOR THEORY 101



If the direction of the current is reversed just as the loop passes the neutral plane, the magnetic force will carry the loop through another half turn (back to the neutral plane). Reverse the current every time the loop passes through the neutral plane, and you have a motor!

The current is reversed by a commutator and brushes (Figure 2). Each end of the wire loop is attached to a contact (these contacts make up the commutator). The contacts spin around with the loop and make contact with the brushes. For half a revolution, one contact rubs the "+" brush and the other rubs the "-" brush. When the loop crosses the neutral plane, the contact that was touching the "+" brush touches the "-" brush and vice versa, and this reverses the current.

IS IT REALLY THAT SIMPLE?

No. If the loop of a one-loop motor happens to be in the neutral plane when you turn on the current, the loop won't turn by itself. If your motor has a second loop 90 degrees to the first, when one loop is in the neutral plane, the second loop will always be in the magnetic field. Add a third loop, and two of them will always be in the magnetic field and thus provide torque. Of course, having more loops would be even better, but R/C motors usually have three loops to prevent the motor from becoming too complex, i.e., expensive!

These loops aren't wound around thin air, the way it looks in the drawings. The magnetic field of the wire is much stronger when the loop is wound around a steel or iron core. Most cores are made of many thin laminations to minimize power loss. If the core

(Continued on page 92)

ELECTRIC MOTORS are pretty cool: just flip a switch and 'round they go! No fueling, no priming, no yanking on a starter rope. I hope that a little practical motor info won't spoil the "magic" for you.

All but a few R/C motors are two-pole, three-loop, permanent-magnet, direct-current motors. "Two-pole" means that they have two magnets and "three-loop" refers to the three coils of wire on the armature. "Permanent magnet" means that they use real magnets, not electromagnets. And "direct current" means that they run off batteries, not off household alternating current (thank goodness!).

MOTORS 101

As current flows through any wire, it creates a magnetic field. The strength and direction of this field are determined by the strength and direction of the current. If you put a current-carrying wire between two magnets, as in Figure 1, the interacting magnetic fields—that of the wire and that of the magnets—will move the wire. Reverse the current, and the wire will move in the opposite direction.

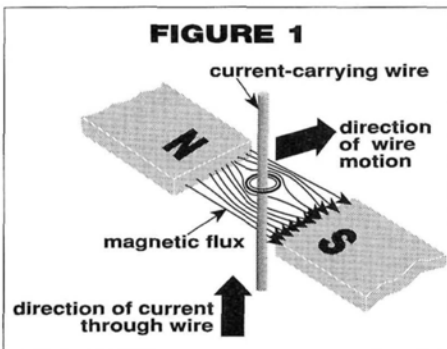
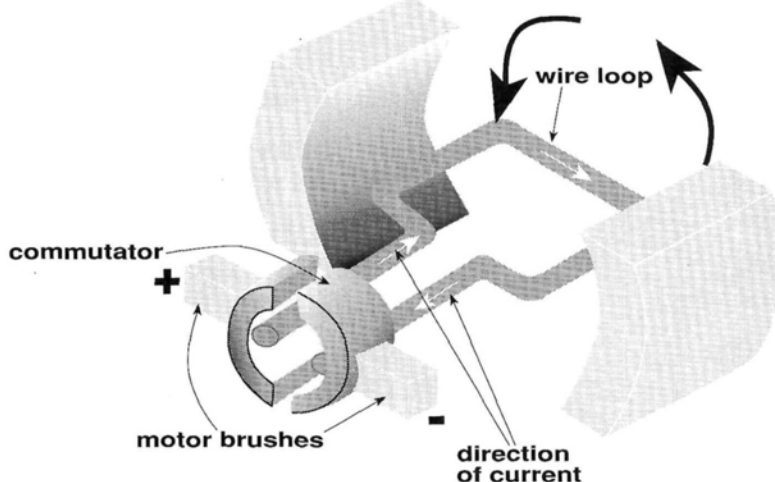


FIGURE 1
Current-carrying wire has a magnetic field that will push against another magnetic field. The direction of push can be reversed by reversing the current.

In a loop of wire (Figure 2), as current flows into one side and out of the other, the magnets will push one side of the loop in one direction and pull the other side in the opposite direction (this position develops maximum torque). If the loop is free to rotate, it will turn 90 degrees until it reaches the neutral plane where magnetic forces are balanced and movement stops.

FIGURE 2



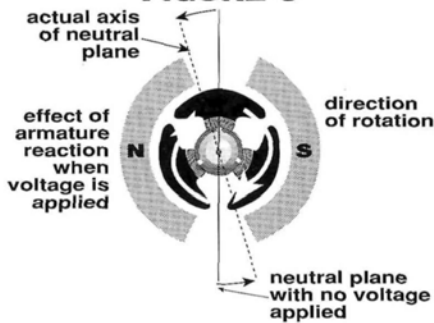
The simplest electric motor. Current flowing away from you on the left pushes the left part of loop downward; current flowing toward you on the right pushes the right part of loop upward.

were solid, it would bleed power away from the wire. Laminations decrease this tendency.

Each loop is made of several turns of wire and is called an "armature coil." Wires that can conduct more current make stronger magnetic fields and enable the motor to generate more power. To get higher current and to lower resistance, the manufacturer has to use larger wire. Larger wire takes up more room, so the motor can't have as many turns. The bottom line is this: motors with fewer turns draw more current and develop more power. A 13-turn motor has more power than a 27-turn.

Another way to cram more current through a motor is to use multiple-filament

FIGURE 3



As the motor spins, the armature field reacts with the main field to move the neutral axis. For efficiency, the brushes must be at 90 degrees to the actual neutral plane. This is why motors are "timed."

WORDS THAT WILL MAKE YOU SOUND COOL

ARMATURE. The rotating part of the motor, consisting of the core, the coils, the commutator and the shaft. Old folks call it the rotor.

ARMATURE REACTION. The interaction of the armature field and the main field that causes the neutral axis to shift when the motor is running.

BACK EMF. Reverse voltage that's generated by a spinning motor and that limits its current draw. A stalled motor draws maybe 10 times the current of a spinning one because a stalled motor can't generate back EMF.

EDDY LOSSES. Unwanted, wasteful, parasitic electricity that flows through the armature core. Cores are made of many laminations to reduce this loss.

EMF. Electromotive force. Cool name for voltage.

FLUX. Think of it as magnetic "current."

MAGNETOMOTIVE FORCE. Think of it as magnetic "voltage."

NEUTRAL PLANE. The area between the magnets in which the armature coil doesn't develop any torque.

POLES. The stationary magnets inside the motor case.

POWDER METALLURGY. The manufacturing process that's used to make magnets. Fine metal powder is molded under tremendous pressure until it becomes a solid magnet. This process is also used to make bronze bushings.

windings. Instead of using one large wire, two to six smaller wires are wound in parallel. Multiple windings use space more efficiently, so manufacturers can use more copper in each coil for lower resistance.

WHAT ABOUT MAGNETS?

R/C motors depend on permanent magnets for operation, and stronger magnets make more powerful motors. Manufacturers strengthen magnets by making them denser and by using stronger raw material. Today, 4.5-, even 4.9mm-thick magnets are common, and Trinity uses 4.95mm-thick magnets in some of its motors.

Magnets can be made of a few materials, including steel, cobalt and samarium. Magnets are often a combination of these elements and are made using a process called "powder metallurgy" in which magnetic materials are ground into a fine powder and injected into a mold and pressed (under tremendous force) into the curved shape of a motor magnet. Some magnet material is mixed with a binder (glue). Many manufacturers use "wet" powder to produce denser magnets.

FOR EXTRA CREDIT

I've already mentioned the neutral plane, and I told you that it's at 90 degrees to the magnets' field center, as shown by the solid line in Figure 3. When no current flows, this is true and it's called the geometric neutral plane. When the armature starts to carry current and spin, it makes its own magnetic field, and things become complicated.

The armature field reacts with the main field (that of the motor magnet) and this interaction distorts the overall field inside the motor case. The result is that the neutral plane is shifted in the direction opposite the direction of rotation. Higher current and rpm cause a greater shift. When the neutral axis shifts like this, the motor develops less torque and becomes less efficient.

Ten points to anyone who can tell me what to do about it!

The important thing is to keep the brushes at a right angle to the neutral plane. If the neutral plane moves, what do you do? Move the brushes! Motor makers predict where the neutral plane will be at optimum speed, and they set the brushes accordingly.

Another way of looking at it is this: the more you shift the brush axis, the farther the neutral plane can move before the motor loses too much torque. If you haven't

(Continued on page 126)

DRA

by MIKE OGLE

WHEN Bob Richardson of Placentia, CA, retired after 20 years of wrenching full-size, top-fuel dragsters and funny cars, he just couldn't get the need for speed completely out of his system. And when he discovered R/C drag racing, he wanted to do something really different, really trick and, of course, really nitro-fueled. So, he teamed up with noted 1/8-scale gas-engine wizard Steve O'Donnell to build "Richardson's Rocket"—an ultra-clean, 1/8-scale, twin-engine,

OPS® .21 dragster.

Originally built for just one .21 engine, O'Donnell's car has a 33.5-inch wheelbase, a U-shaped aluminum channel. The aluminum engine plate, the G-10 fiberglass radio tray and the wing struts make the chassis rigid and lightweight. To protect it from the vibration and electrical "noise" that's created by the twin modified OPS engines, the Airtronics® FM receiver is suspended above the radio with heavy rubber bands. The radio tray also houses twin gas tanks so that the two engines can be



With the body off, you can see the fuel tanks; they allow the engines to be fired-up separately for independent tuning. The gear-drive system is also shown.

RICHARDSON'S

1/4-SCALE ROCKET

HOME-BUILT PROJECT

run and tuned independently.

The engines really set this car apart. O'Donnell tuned them by modifying the port timing, and he made special crankshafts for dual running. He connected the engines with two Serpent* clutches and a specially built gear-drive system. The car can run dual two-speeds, but to engage them both at the right time is a tuning headache that Richardson hasn't tackled yet. The exhaust is routed to two tuned expansion-chamber pipes. Although they've greatly improved performance, Richardson wants to try lighter, more aerodynamic pipes. The solid (no diff) rear axle is connected to the gear-drive system with a belt, and the car also has a rear disk brake.

The dragster uses Arrows* 3-inch-high, medium-compound rear tires, and the traction compounds range from 50 to 100 percent tire bite. The front end has a pivoting beam and O'Donnell's custom-machined aluminum front rims.

Lest anyone think that this car is all show and no go, the Rocket's best performance in the 1/10-scale quartermile (as of this writing) was just below the 2-second mark—1.99, with a 63.5mph top speed. To the best of my knowledge, this was the first gas-powered car to go sub-2. But Mr.

Richardson has a lot of competition on the West Coast. A few of O'Donnell's single-engine cars are out there, and some new gas dragsters built by Rick Yoder are coming to the strip, and they're all nearly as quick as the Rocket. (You can call Yoder about his dragsters at 714-862-8463.)

If they do start to catch him, Richardson will just have to "tip the can" more and up the nitro percentage in the fuel mixture, or maybe do some "woodshedding" with the two-speeds. Then, he may even scare the electric-powered guys with his car's performance! ■

*Here are the addresses of the companies mentioned in this article:

QPS; distributed by Shamrock Competitions Imports, P.O. Box 26247, New Orleans, LA 70186.

Airtronics Inc., 11 Autry, Irvine, CA 92718.

Serpent TenForce; distributed by R/C Motorsports of Miami Inc., 4715 NW 167, Ste. 204, Miami, FL 33014.

Arrows Tyres; distributed by Racer's Choice R/C Products, P.O. Box 405, Medinah, IL 60157.

ON'S ROCKET

by
JEFF BRONSTEIN

NOPE, YOU'RE NOT imagining things: that *is* a Schumacher* sticker. Yes, on an on-road car—an on-road gas car! In the past, Schumacher has focused on the off-road scene. Lately, however, more and more of the U.K.-based manufacturer's valuable R&D time has

been spent on nitro-powered vehicles. And why not? Gas racing is hot! In fact, Schumacher was one of the first manufacturers to invest heavily in gas racing; the result was the very popular line of Nitro 10 off-road trucks and buggies. With the introduction of its 1/10-scale Nitro 10 "Daytona" racer,

Schumacher has taken the next logical step into on-road and oval gas racing.

Schumacher's design team in England and its team drivers in the U.S. really did their homework before they introduced the Daytona. Its full-suspension rear end and floating-king-pin front end are a



PHOTOS BY JEFF BRONSTEIN

nitro

SCHUMACHER DAYTONA

unique blend of the suspension and pan classes. The Daytona's fully assembled rear end is based on the Nitro 10 gas truck, and the Shotgun electric racing truck. The drive train is Schumacher's tried-and-true belt-linked drive shaft and Pro ball diff coupled to telescopic

drive shafts.

In all the new Schumacher kits, the rear suspension arms are molded of PEP (performance-engineered polymer)—a high-tech polymer that's virtually unbreakable. One Schumacher engineer described this material as "less brittle, twice as rigid

nightmare



DAYTONA



three times as strong as the plastic material used on previous Schumacher cars." The adjustable upper control links use turnbuckle tie rods that make camber adjustments easy. Completing the rear setup are hard-anodized aluminum Vari-shocks.

Everything about this car is predictably Schumacher—except the front end. The Daytona's front-end design is very atypical of Schumacher's engineering approach. The designers in this company usually blaze

A set of Tecnacraft's* gold-anodized aluminum rims made for some dazzling Daytona developments.

their own trail, march to a different drummer, sing a different tune, talk like...well, I think you get the picture. But rather than design their own front suspension, they duplicated the front-end arrangement of the most popular on-road chassis ever introduced—the Associated RC10L.

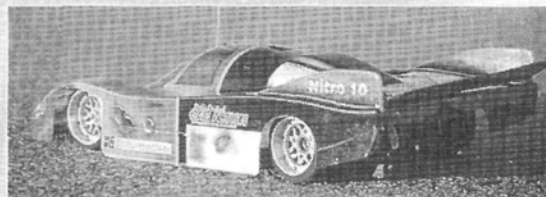
From the midpoint of the all-graphite pan chassis forward, the Daytona is identical to the 10L. At first, I wondered why they did this, but the simple fact is that it works. What's even better is that every front-end part designed for the 10L also works with the Daytona (including the new Associated 10L advanced front end and the Trinity Evolution).

The Daytona's powerplant is the potent Irvine .15 Speed engine. It's installed in front of the rear drive, and its large heat-sink head slopes forward over the chassis so that the crankshaft-mounted pinion gear can engage the spur gear. This setup also lowers the car's center of gravity. A simple but effective centripetal clutch engages the pinion assembly, and with a special tool, you can remove the clutch bell easily for adjustments and cleaning. A custom muffler vents exhaust out of the rear of the car through a rubber tube. For improved performance, a tuned pipe and a manifold are available as options.

Two features sure to be big selling points are an easy-to-use pull-starter and an on-board glow ignition system. For quick, easy starts, just fill the tank with racing fuel and pull the rip cord.

Unfortunately, the instruction manual was still being printed when I received the kit, but if the Daytona manual is anything like other Schumacher manuals, it will be accurate and easy to follow. Even without the manual, building the Daytona is very

SCHUMACHER DAYTONA



Type On-road/oval
Scale 1/10
Price \$589.95

DIMENSIONS:

Length 17 inches
Width 8.85 inches
Wheelbase 10.5 inches
Front Track 8.5 inches
Rear Track 8.75 inches

WEIGHT:

Gross (with battery) 3 pounds, 6 ounces

CHASSIS:

Type Pan
Material Graphite

DRIVE TRAIN:

Primary Pinion/spur/clutch
Transmission Belt drive
Differential Pro ball diff
Bearings/Bushings Bushings/ball bearings

SUSPENSION:

Front: Type Floating kingpin
Damping None
Rear: Type Lower A-arm/upper link
Damping Oil-filled shock

WHEELS:

Front/Rear Bolink one-piece nylon

TIRES:

Front 35/40
Rear medium/hard

POWERPLANT:

Engine Irvine .15 Speed with pull-start

OPTIONS:

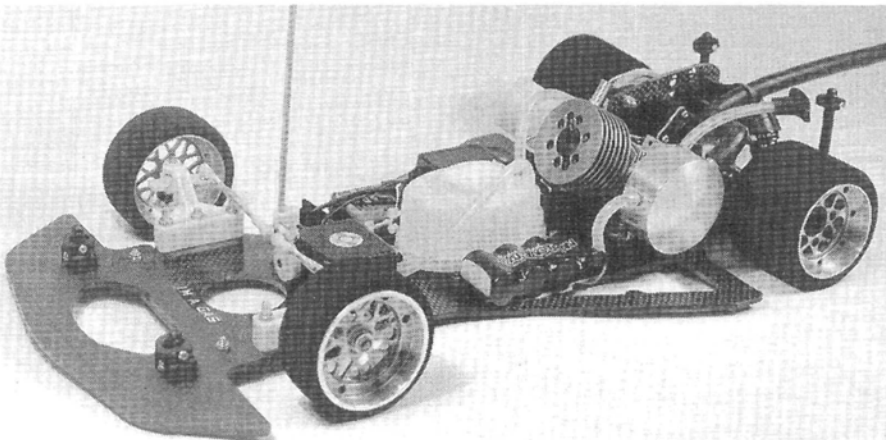
Airtronics CS-2P FM transmitter, Airtronics Pro Series servos (high speed and high torque); Novak NER-3FM receiver; McCoy* Racing Performance glow plugs; Team Losi 20WT shock oil; Horizon Blue Thunder 20-percent-nitro fuel; Andy's Porsche 962; Tecnacraft gold-anodized 1/10-scale rims.

HITS

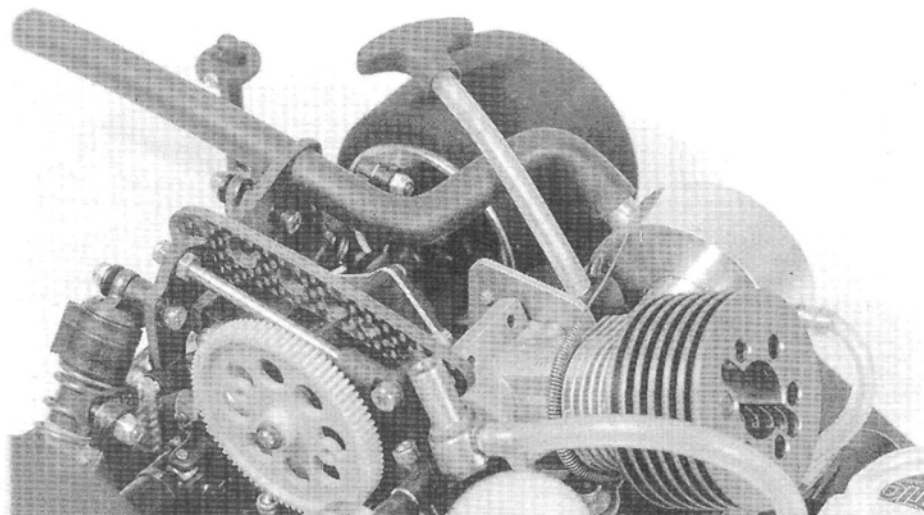
- Unique compromise between full-suspension and pan classes.
- Pull-start and on-board glow igniter are perfect for nitro novices.
- Irvine .15 provides potent performance.

MISSES

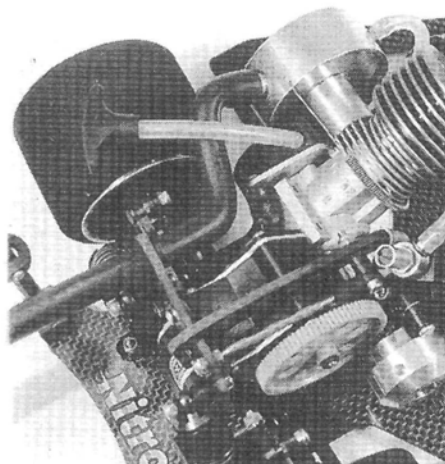
- More expensive than most 1/10-scale gas vehicles.
- Only .15-size gas entry available—others use .12 engines.



The Daytona is the perfect mixture of the full-suspension and pan classes. There's no doubt about it; this unique combination works very well.



The special "can"-looking muffler vents the exhaust out through a long rubber tube. An optional tuned pipe improves performance dramatically.



The potent Irvine .15 Speed engine is tipped to its side so that the crankshaft-mounted pinion gear can engage the spur gear. This also lowers the car's center of gravity.

easy. The transmission and engine are assembled at the factory, relieving you of a substantial part of the construction. After you join the rear drive and the chassis, assemble the drive shafts and install them with the lower A-arms and the upper control links. To assemble the front end, install the two 10L wheel carriers and, with the included hardware, mount the steering servo between the front steering brackets. The throttle/brake servo is in a slightly more precarious position—below the engine heat sink and alongside the fuel tank. It will probably be exposed to fuel and heat, so use a sealed servo, or at least fuelproof a standard servo with a sealant that won't harm the servo's plastic.

Although the car is intended for both on-

road and oval gas racing, I chose a slick GTP body to top off the whole package. Andy's* provided the streamlined Porsche 962, and Todd Kerby of TK Designs* added a "wet'n'wild" custom paint scheme. Rear downforce seemed as if it might be a problem for the wingless Porsche, so I added a

**With Schumacher's help,
gas racing is slowly
shedding its reputation of
being complex and difficult.**

Parma* wing to the tail for better traction. A set of Tecnacraft's* gold-anodized aluminum rims made for some dazzling Daytona developments.

After the photo shoot, and with little more than my Airtronics* CS-2P and a bottle of 20-percent-nitro Blue Thunder* fuel (I strongly recommend that you use a low-castor fuel blend), it was off to the track for the initial test drive. Although I was anxious to get the car on the track, I restrained myself just long enough to break-in the engine properly, using a fairly rich needle setting for three to four tanks of fuel.

The first time I saw the Daytona, Team Associated driver Mike Swauger (Team Schumacher for a day) drove the prototype to its first U.S. TQ at the Nitro Shootout in Albuquerque, NM. After watching his performance, my expectations for the Daytona were understandably high. With a quick flip of the igniter switch and a sharp pull on the starter, the Daytona came to life. After a few warm-up laps, I began to dial-in the carburetor. The high-speed needle is easily accessi-

ble from the top of the car, and the low end can be reached with a narrow screwdriver. I carefully monitored the head temperature between adjustments as the Irvine slowly got to its feet to do some gas blasting.

Finally, it was time to unleash the Daytona's full potential on the race track. As with most cars, it only takes practice and some experimenting to dial-in the Daytona. At first, I was amazed at its speed, but the car tended to understeer (it pushed)—a safe condition for novice drivers, but not the fastest way around a race track. The Bolink tires and wheels that came with the Daytona seemed soft enough, but the fronts are interchangeable with any popular 1/10-scale wheel (a big plus), so I decided to try some super-soft-compound fronts. After a few more laps, the car's handling improved and the lap times started to fall.

Still, it seemed as if I could do more to increase the car's performance. The roll-couple at the front of the car is very high, i.e., most of the weight transfer is forward, so a heavier spring at the rear and a lighter spring at the front seemed rational. The car performed even better. The rear end started to drift slightly in the corners, and the steering was much more responsive.

Although it hardly seems relevant to compare the Daytona's performance with that of an electric car, I feel compelled to brag about this car's performance. On the infield, this car performs as well as or better than most modified electrics, and when it hits the back straight, it really heats up and leaves its electric competition coughing in the smoke. Because it uses a suspension rear end, the car falls in the "full suspension" category of 1/10-scale gas racing. After you've seen the performance of this nitro nightmare, you'll have no doubt that it can hold its own against some very fierce competitors.

The Daytona is the most competition-ready vehicle in the Nitro 10 line. With Schumacher's help, gas racing is slowly shedding its reputation of being complex and difficult.

**Here are the addresses of the companies mentioned in this article:*

Schumacher Inc., 6302 Benjamin Rd., Ste. 404, Tampa, FL 33634.

Andy's R/C Products, 1710 Grevelia Ct., Ontario, CA 91761.

TK Designs, 1623 East Casper, Sandy, UT 84092.

Parma International Inc., 13927 Progress Pkwy., North Royalton, OH 44133.

Tecnacraft, 1335B Dayton St., Salinas, CA 93901.

Airtronics Inc., 11 Autry, Irvine, CA 92718.

Blue Thunder; distributed by **Horizon Hobby Distributors**, P.O. Box 3726, Champaign, IL 61826.

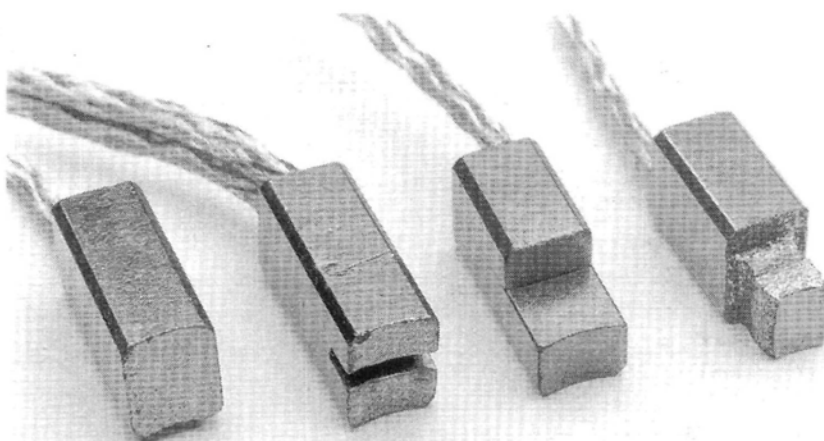
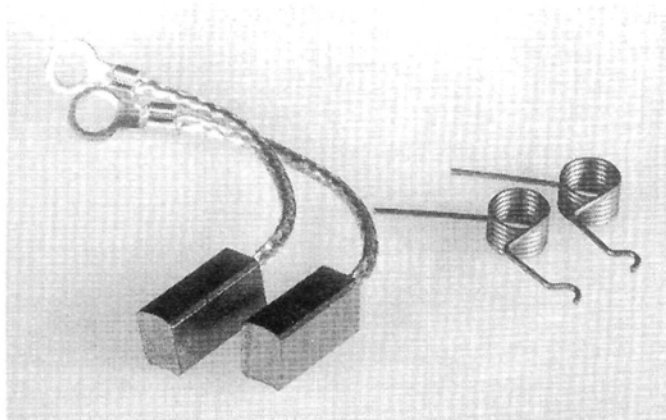
McCoy Racing, 1778 Albright Ave., Upland, CA 91786.

Team Losi, 13848 Magnolia Ave., Chino, CA 91710.

by FRANK CALANDRA

Motor Spring & Brush Selection

UNRAVELLING THE MYSTERY



● **Brushes**—compressed particles of graphite, copper, and sometimes, silver, designed to transfer electrical energy from the battery to the motor's spinning armature.

● **Brush springs**—keep the brushes pressed firmly against the rotating commutator.

Simple, right? No way! These small, inexpensive components play a major role in performance. Motor efficiency, power and torque all depend on the proper brushes and springs. There isn't a perfect method for selecting brushes and springs, but keep these principles in mind when you prepare your motor for racing.

BRUSH SELECTION

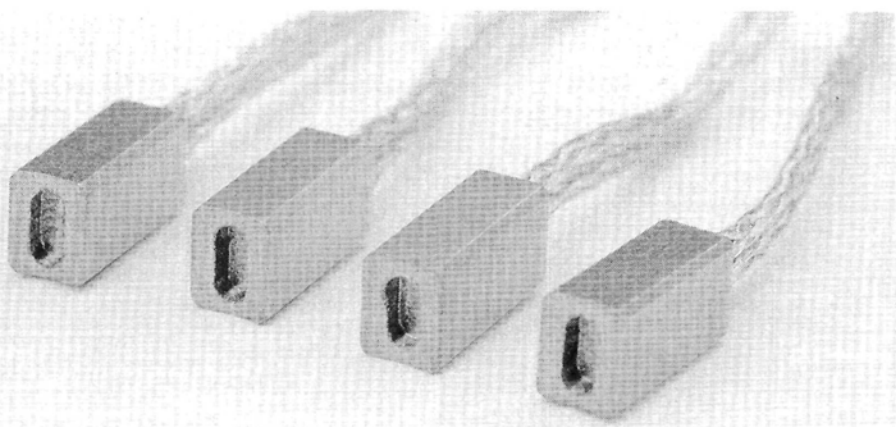
Brushes all look alike, but they vary substantially in composition and quality. Brushes are made of copper, graphite and silver powders that have been compressed into a solid shape.

Brushes can differ in material and shape. Some of the most popular shapes are (from left) full, slotted, off-road, and triple-cut.

The mixture of these materials and the particle size change the characteristics of a brush. The shape or "cut" of a brush also alters its performance.

● **Stock motors.** When you select brushes for stock motors, your main concern is horsepower. Run time and efficiency are less important. Delivering high amperage from the battery to the motor is the key to stock performance, so it's best to look for a brush that has a high copper content. The copper's low resistance and excellent heat conductivity are essential to building horsepower in stock motors.

Manufacturers don't label brushes by their composition, so look for brushes with a rich, chocolate-brown color—this indicates high copper content. Brushes that fit this description are Reedy's* Ultra no. 3512, Trinity's* no. 4038, Class's* Soft no. 7002 and Revtech's* MHX. Stay away from brushes that have heavy streaks of gray or black; this indicates high silver or graphite content. Silver will increase the rpm slightly



Another type of brush is the "venturi." Some of the brush's center material has been removed to reduce the surface area that contacts the comm. This cavity also helps to keep brush deposits from gumming up the comm.

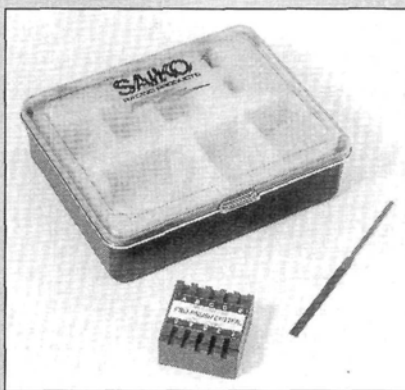
(and fool the dyno, if you're not careful), but it will also decrease the motor's torque or "punch." With stock motors, it's always more difficult to develop gear-ripping punch than top speed. Excess graphite in the brush can cause the buildup of brush glaze (graphite on the end of the brush). This buildup increases the brush resistance and causes the motor to be flat or "lazy."

● **Modified motors.** With modified motors, run time, efficiency, commutator life and overall horsepower are all very important. Modified motors draw more current and turn more rpm than stock motors, and that's why run time and efficiency are a big issue.

As with stock motors, high-copper brushes are a good choice for modified motors. High-copper brushes work well in most modified racing, but watch out for brush glaze and pay attention to run time when you use them.

The value of silver in brushes is debatable. Silver is an excellent conductor of electricity, but it's very abusive to the soft copper commutator (the polished and trued, round surface where the brushes contact the armature). The commutator's condition is crucial to motor performance. During a race, the commutator might be damaged to a point at which any gain from silver will be negated by motor inefficiency. Also, at high temperatures, silver's resistance is higher than that of copper.

The silver content of brushes can range from zero to 15 percent. Silver is best used under constant, high-rpm conditions, i.e., on a fast track without slow corners. Therefore, in high-speed, paved-oval racing on large tracks, silver's harder surface and lower resistance are advantageous. Unfortunately, to ensure the best performance, the commutator must be re-trued after every race. Be careful with silver. Make sure that it gives you an increase in performance, because there will be a definite decrease in motor life.



The Saiko Racing Products* Pro-Brush Cutter allows you to modify your own brushes. It comes with a hard-anodized, aluminum, brush-cutting jig, a high-quality file and a tough storage case. It will transform any full brush into timed, off-road (pro-cut), or triple-cut. Put the brush into the desired slot (choose from 10 cutting depths: five for the timed side of the jig, and five for the pro-cut side) and file it until the cut is even with the jig.

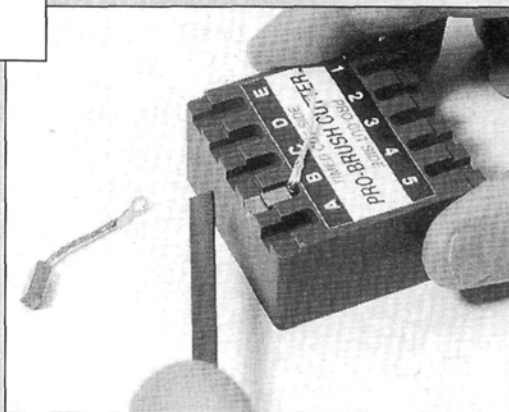
Cutting Brushes

In most cases, full, uncut brushes provide a motor with the proper power band and sufficient motor efficiency. Brushes can, however, be cut to change the way they deliver power to the motor. The following terms are used to describe brushes that have been reshaped.

● **Timed brushes** were developed years ago when stock motors had very little timing—3 to 6 degrees.

The trailing edge of a timed brush is removed, shifting the contact patch of the brush and increasing the timing. Although timed brushes do raise the unloaded rpm, they don't substantially improve the performance of 24-degree (and higher) stock motors.

● **Off-road, contoured and split brushes** have approximately one-half the brush face removed. They're full width but only half the height. With less brush material on the comm, amp draw is lower and run time is slightly higher. With a smaller area in contact with the comm, however, the brushes' ability to conduct is reduced (comparable to a smaller, 22-gauge wire versus the larger 12-gauge). Expect a decrease in low-end to mid-range acceleration because of the brushes' inability to deliver the high current demands under load.



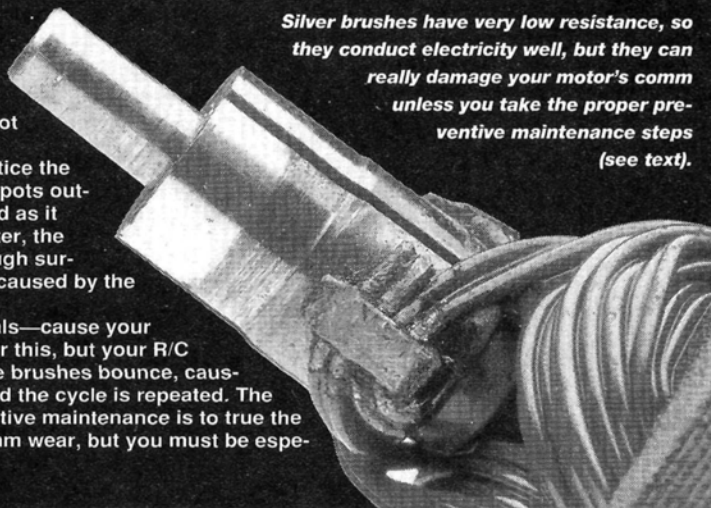
There are conditions in which a cut brush will increase acceleration at the extreme low end of the power band, say the first 2 feet of car movement. This is because of the lower frictional losses of the smaller brush face. This can be advantageous on tracks with very slow corners, such as a tight, 1/2-scale track. To pick up a little run time, use a half-height cut brush. ● **Slotted, venturi, hollow and cavity brushes** are designed with cooling and ventilation in mind. These types of brush will keep the brush area cooler and may allow you to gear up an extra tooth for higher speeds. A cooler brush tip will lessen the chance of glazing, consequently decreasing lap times late in the race. Furthermore, the hole or cavity in these brushes catches brush residue, and this keeps the conducting surfaces cleaner.

The Effects of Silver Brushes on Motors

Silver improves performance through low resistance, especially in hot modified motors, but it's very rough on the commutator. The photo shows an armature that has received one cut from a motor lathe. Notice the black areas near the comm slots that remain after one pass. These spots outline "divots," or depressions in the comm that the tool never touched as it passed from one end to the other. As the motor spins faster and faster, the brush springs are unable to keep the brushes in contact with the rough surface. The brushes are thrown off the comm and an arc is produced (caused by the inductive forces acting on the motor).

The same inductive forces—electricity jumping between two metals—cause your spark plug to fire in your full-size ride. The spark plug is designed for this, but your R/C motor isn't! It's a snowball effect: silver wears the comm quickly; the brushes bounce, causing excessive arcing; the arcing removes copper from the comm; and the cycle is repeated. The comm should be inspected for wear after every run. The best preventive maintenance is to true the comm with a mini-lathe after every run. All brushes cause some comm wear, but you must be especially careful when you use silver brushes.

Silver brushes have very low resistance, so they conduct electricity well, but they can really damage your motor's comm unless you take the proper preventive maintenance steps (see text).



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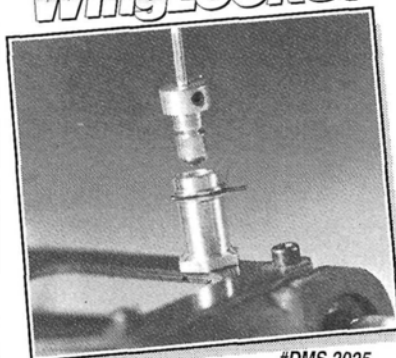
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MOTOR SPRING & BRUSH SELECTION

The metal components of the brush (copper and silver) deliver the current, while graphite lubricates the brush. With more metal, friction/resistance are lower, but there's more commutator wear. With more graphite, resistance is higher, but the brush is lubricated more, and this increases comm life.

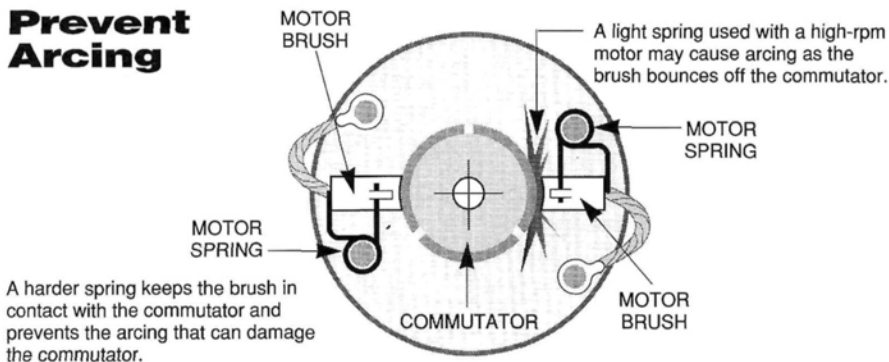
SPRINGS

Good motor performance is the result of having low-resistance connections from the battery through the speed controller to the motor. The last link in this path is the junction between the

causes the brush to pinch the comm, and this increases the resistance in the motor. A heavy spring will also decrease your run time slightly.

Use a heavy spring when the motor will be subjected to continuous loads. Muddy, sandy, or hilly off-road tracks stress your motor more, so you'll need a heavy spring to deliver the necessary amperage. Also, small, banked carpet ovals that cause the car to scrub speed and bog down may call for heavy springs. Tracks with slow corners that require strong acceleration are good places to try heavy brush springs. Most stock motors need a firm spring

Prevent Arcing



brush and the commutator. Brush springs keep the brushes in constant contact with the rotating commutator. Simple as it may be, different conditions require different spring selection.

• **Light springs.** Light springs lower a motor's mechanical resistance. The brushes contact the commutator with less force, so there's less friction and, therefore, less resistance. This raises the motor's unloaded rpm and lowers its amp draw. Great! More speed with fewer amps; it would seem that light springs are the only way to go.

Unfortunately, under heavy loads (acceleration), a light spring may allow the brush to bounce off the comm, creating momentary gaps between it and the brush that increase the motor's electrical resistance. This bouncing causes heavy electrical arcing between the comm and the skipping brush. Each arc removes copper from the comm, and this quickly destroys a good motor.

With that in mind, light springs should be used for wide open tracks with no slow corners. Large oval tracks with corners that are taken at full, or nearly full, speed are good places to try light springs. In this situation, the motor accelerates once (at the start) and stays at full speed for the entire race. The increase in rpm allowed by a lighter spring may be an advantage under these conditions.

• **Heavy springs.** Heavy springs keep the brush pressed against the comm, and create a low-resistance connection between the battery and the motor. This firm pressure, however,

to develop good "punch." This is partly because of the big pinion gears generally used in stock racing. Rough off-road tracks also require a heavy spring to keep good contact over the rough terrain.

Contrary to popular belief, a heavy spring won't damage the comm more quickly than a light spring will. As discussed above, a light spring is much more susceptible to arcing than a heavy one, and excessive arcing can quickly ruin a motor.

Test all brush and spring setups on the track with a stopwatch; it doesn't lie. Look at the lap times of the entire race—not just the quickest lap. At handout races, comm life plays a big part in brush and spring selection. What good is a fast motor if the comm is destroyed before the main event? At your local track, find out what the "hot shoes" are running, and start from there. Try other setups, and always keep notes so you know what works and what doesn't. The proper brush and spring selection will increase motor performance and life, and this will enable you to motor into the winners' circle more often.

**Here are the addresses of the companies that are mentioned in this article:*

Reedy; distributed by Associated Electronics Inc., 3585 Cadillac Ave., Costa Mesa, CA 92626.

Trinity Products Inc., 1901 E. Linden Ave. #8, Linden, NJ 07036.

Class Recreational Products, RD1, Box 187A, Utica, NY 13502.

Revtech R/C Products, 7401 White Ln., #19, Bakersfield, CA 93309.

Bud's Racing Products, 1575 Lowell St., Elyria, OH 44035.

Saiko Racing Products, P.O. Box 1515, Tustin, CA 92681.



ALL THE DIRT THAT'S FIT TO PRINT



RADIO CONTROL CAR ACTION

RACER NEWS

WORLD CLASS RACING

It's no secret that **Schumacher**, a British-based, world-leading manufacturer of 1/10-scale off-road cars, has gained "critical mass" in the United States with its hot lineup of racing cars and trucks.

The **prototype** car shown in the photo is a not-yet-named 2WD off-road race machine that Schumacher hopes will win over new legions of **American racers**.

According to our mole in the Schumacher R&D department (to protect his anonymity, we'll refer to him as "Agent Kippers"), the new car is a **radical departure** from the current Cougar models, and its design makes extensive use of sophisticated CAD/CAM

computer equipment—especially in the areas of **structural rigidity** and suspension geometry.

The car will have a **dual-plane** fiberglass chassis that's held with molded cross-braces for maximum strength. Extra-long front and rear suspension arms will make the car **easier to drive** on extremely bumpy tracks. The new car will have an all-new gear-drive tranny—no belts! Other notable features are new, one-piece rims, a **battery-retaining brace** that runs lengthwise over the pack to keep it secure and a totally new front steering-arm arrangement that appears to have a conventional design, e.g., the front wheel bearings are in the wheels themselves.

With such **winning designs** as the 4WD BossCat and the new Nitro 10 Daytona, backed up by **great service** from Schumacher Inc. in Tampa, FL, I think that more than a few American customers will line up at hobby shops for a look-see.



ALL NEW 2WD RACER FROM SCHUMACHER!

C O N T E N T S

112
ROAR 1/8-Scale Nats

116
Joel's Winning Evolution 10

120
Speed Shop



THE BOTTOM LINE ABOUT 1/8-SCALE OFF-ROAD DIFFS

As gas racing becomes more popular, enthusiasts become hungrier for technical information.

Four-wheel-drive gas off-road cars such as the Kyosho Inferno and the Mugen Super Sport use three gear-type differentials. The thickness of the grease used in these diffs can affect their operation—and the car's performance—substantially!

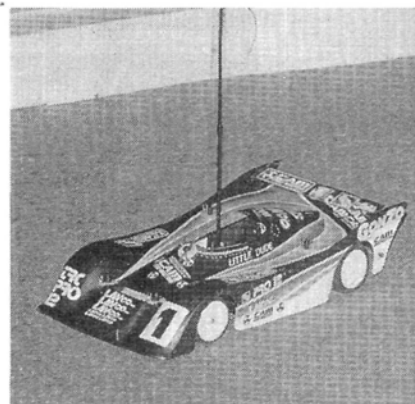
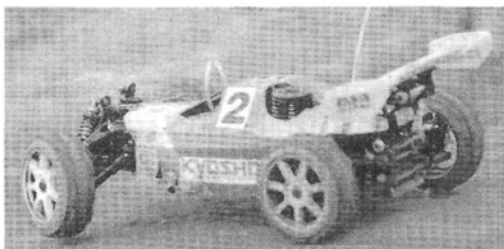
Center diffs are perhaps the most crucial. Their job is to ration the engine's power between the front and rear sets of tires. If the center diff's action is too free, **acceleration is hampered**: when the car accelerates, weight is transferred rearward, and a diff that's too free will send more of the engine's power to the unloaded front wheels and less to the rear wheels—**not what you want!**

To remedy this situation, racers "pack" their cars' center diffs with thick grease (some Team Kyosho drivers use very thick silicone fluid), and this tightens the diff's operation by providing frictional resistance to the diff's action. It's important that you use grease that will cling to

the diff gears and won't be "slung off" when the diff spins at a high speed.

A center diff that's too "locked" will also have a negative effect on the car's handling. A tight center diff will prevent **shock transferal** (when the car goes over a bump or lands after a jump) between the front and the rear ends. A looser center diff absorbs shock and transfers it to the opposite set of wheels. Obviously, a happy medium is **most desirable**.

Regarding front and rear diffs, a loose setting (thinner grease or thinner silicone fluid) yields more off-power steering, and a tight setting (thicker grease or fluid) gives more on-power steering. In addition, front and rear diffs should be set as equally as possible; if they aren't, most drivers find that the front and rear diffs seem to "fight" each other.

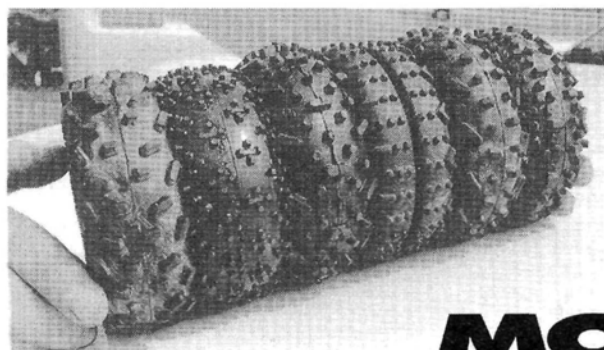


CHAOS AT CLEVELAND

At the Cleveland Indoor Champs, held on November 27, 28 and 29, Chris Doseck took control over some bad first-turn confusion, didn't look back and won the A-Main.

TQ'er Joel Johnson, the favored contender going into the race, was one of the few who had problems off the start and tangled with a few other competitors. Joel showed up at the race with a prototype **Trinity Evolution 12** (based on the 1/10-scale car he used to dominate the Worlds) and spent most of his time and battery juice playing catch-up to Doseck, who, while out front, ran a **flawless** race.

There will be a complete look at the Cleveland race in an upcoming issue.



We've heard that Mugen USA will import those trick French Mondial tires for 1/8-scale buggies that we featured in January in our coverage of the **Kyosho Gas Challenge**. Jack Johnson used them on his TQ Kyosho Inferno there and Kris Moore used them on his A-Main-winning car. We mistakenly told you they were Italian tires in the coverage; our apologies to Jacques Cousteau and all his Calypso buddies. There's no word on availability or price yet, but as soon as we get more info, we'll pass it along.

MUGEN'S MONDIALS



R/C CAR ACTION PRESENTS THE 1992

1/8-SCALE NATS



NITRO THUNDER

by JOHN THAWLEY

BILLED AS "NITRO Thunder," and sponsored by *Radio Control Car Action*, the ROAR 1/8-Scale Gas Nationals drew more than 200 entrants. That's a first!

The race host was the New Mexico Radio Controlled Race Car Club, and the track was a large asphalt area at the New Mexico State Fairground in Albuquerque. The club's well-designed track included a very large drivers' stand, plenty of covered pit space and a professional PA system that kept spectators and participants fully informed. The club handled the scoring with Team SEMROCC Racing's AMB System 20 and B&B's Autoscore.

To say the program went smoothly would be an understatement. NMR-CRCC did an *excellent* job. The only complaint I heard concerned the number of entrants. Gas drivers aren't used to waiting so long between races. If this high attendance is any sign of the rising popularity of gas cars, drivers had better get used to it.

THE NITTY GRITTY

The classes included 4WD, 2WD, Pan Car and Sportsman. The schedule called for six rounds of 5-minute qualifying and 3-minute warm-ups, which partially accounted for the long wait between rounds.

Because of a shortage of entries, the organizers ran the Pan Car and Sportsman Class as one heat. With only four entrants in each class, many drivers asked why these classes had been included in a national event. They're important classes, but they might be better promoted at the local level. I do know this, though: the winners of both classes had to *earn* their victories, and they deserved them!

Also in the program was the *R/C Car Action Shootout*—an exhibition for 1/10-scale gas on-road cars. With 20 entrants, this class of quick, dependable, easy-to-drive cars showed a lot of potential. The Serpent car and the BMT prototype car were most impressive, as was Schumacher's Daytona.

TRICKY BUSINESS

The drivers had to contend with a number of set-up problems.

- The rough track provoked the typical complaints. When I say "typical," I'm not referring to only R/C events. You hear these complaints in USAC, Formula 1, IMSA, Indy, NASCAR and WOO racing as well. Typically, a race promoter will answer, "It's the same track for everybody!" Guess what? It was the same for everybody, but each driver dealt with it differently. Oddly enough, though, the fast guys were still fast.

- Another problem was Albuquerque's high altitude and consequent thin air. The terrain and conditions there are

ideal for the world's largest hot-air-balloon festival, but the altitude made it difficult for drivers to figure out the right fuel mix. Again though, the fast guys were fast.

- The heat also caused problems, and the traction varied with the track temperature. By mid-afternoon, the surface temperature could increase by as much as 60 degrees (from 70 degrees to 130+ degrees). As the track heated up and became slippery, drivers had to wrestle their cars around. Surprise of surprises, the fast guys were still fast.

QUALIFYING

After two days of practice, qualifying got underway. In the first round, Ralph Burch and Mike Swauger took an early lead in 4WD. Another early front-runner was Tom Ramundo. He finished third in the first round with a Porsche 962 GTP body, no less. Arturo Carbonell, driving a BMT car, sat fourth.

In 2WD, local Davey Preston took top honors in round one with a 13/5:10.98. Curtis Husting was second only 4 seconds back. Eric Davis was third and Sean Cochran was fourth.

The heat affected the action in round two. Only a few drivers moved up into the top ten with better times. In

4WD, Robert Ronas moved up to fifth and Frank Calandra moved into ninth position. John Alton wrestled his 2WD car to the third fastest qualifying time. Mark Miranda picked up sixth, and Charlie Leinbach finished his second round in eighth.

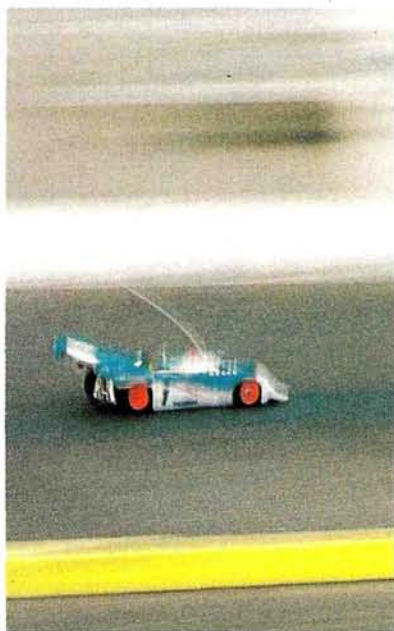
With the track surface cooling down a little, round three was pretty productive. Burch raised the price of admission by turning in the first 15-lap run in the 4WD class. Ronas, Calandra, Joaquin DeSoto and Mark Blaketter improved their times to end the day fifth, sixth, seventh and eighth respectively.

Meanwhile, Preston and Husting continued to put on a show in 2WD. Both drivers improved their times on the cooler track with Preston staying on top. Brent Gottfried picked up the fourth spot and Howard Cano picked up eighth.

Day two of qualifying started quietly. Swauger went a little faster in round one but not fast enough to catch Burch's 15-lap run of the day before. Carbonell and Ramundo improved their times with no change in their



Here's a quick look at the concours entries.



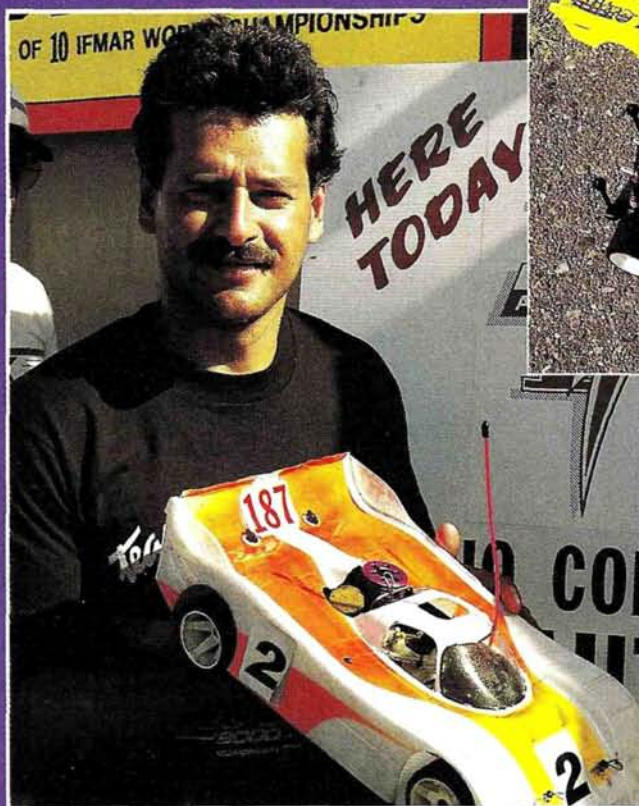
The "ROAR Gals" (left to right): Natalie Romero, Phyllis Barela and Jessica Gonzales.

Radio Control Car Action SHOOTOUT

This year's Gas Nationals included an exhibition race of 1/10-scale gas on-road cars. Rules for these cars are still not complete, but the high quality of the competition was impressive. With some careful planning, this class could have an exciting future.

Standardized rules are a must if this class is to attract industry support. If the governing bodies allow technological development to go unchecked, the class will never get off the ground. Four-wheel-drive cars with three-speed transmissions will send this class to an early grave.

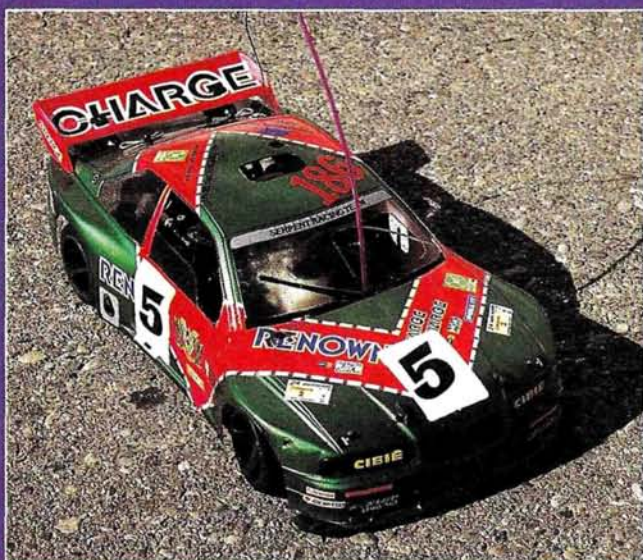
EFRA has the best rules: chassis design is limited to two-wheel rear-drive cars only. It allows gearboxes with a maximum of two speeds and a maximum fuel-tank capacity of 75cc so that all classes can run for 5 minutes without a fuel stop. EFRA also restricts noise level to 77dB(A) measured at 10 meters. These rules are likely to control the growth of



This great-looking Serpent Impact "bimmer" belongs to Peter Bervoets.



Mike Swauger's TQ Schumacher Nitro 10 Daytona.



The winner of the 1/10 scale gas Car Action Shootout was Joaquin Desoto's Serpent Impact.

technology and the cost of racing.

The three cars I looked at were the Schumacher Nitro 10 Daytona, the Serpent Impact 10 and a BMT Prototype from Racer's

Choice. These 2WD cars have independent suspensions and they use 2.5cc/.15 engines. Cars ran with single and two-speed transmissions, and they handled extremely well.

To accommodate smaller cars, the straightaway was shortened by about 25 feet and the sweeper on the far end of the track was removed. These minor changes made the racing close and exciting.

In the first round of qualifying, Frank Calandra and James Choy looked as if they'd invented this class. Calandra drove a Serpent car and Choy piloted the prototype BMT. They finished with Calandra turning 14/5:08.93, only five tenths of a second ahead of Choy. Joaquin Desoto's Serpent was third fastest at 14/5:20.76.

Mike Swauger figured out his Schumacher car in round two, but it wasn't good enough. Swauger managed to pull off a 14/5:06.45 that only tied Calandra, who had improved his second run with the same time. DeSoto also picked up time and moved into third.

Round three was all Calandra. He ran off with a 14/5:04.94 run. No one came

close, but the times were tightening up farther down in the top 10. Fred Bowen-Smith moved into sixth and Sandy Leff and Peter Bervoets fought for seventh and eighth. Leff took it by sixteen hundredths of a second. Stan Hale was ninth and Garth Finley was tenth.

In the final round, Swauger decided to rewrite the book. After not starting in round three, Swauger made amends by turning a ballistic 15/5:15.43—the only 15-lap run of the week in this division. DeSoto took over the number-two spot. Swauger, DeSoto, Calandra, Choy, Bervoets, Larry Pyle, Michael Salven, Bowen-Smith, Leff and Rick Jones headed for the main.

The 15-minute main event was plenty of time for these guys to show their stuff. It was exciting, and the cars really proved their reliability. DeSoto led the pack and finished with a 40/15:05.43. Salven and Calandra went wheel to wheel until Calandra made an error, and Salven finished in second place. Calandra was 3 seconds back in third. Bad luck struck TQ Swauger's Schumacher Nitro 10, and he was out of the race at the 12-minute mark, leaving him sixth.

The 1/10-scale cars were a lot of fun. With good fortune, this class will attract more participation as equipment—and rules—become available. One thing you can be sure of: you'll read about it here!

position. Calandra move up to fifth with his fourth-round run.

In 2WD, Husting moved into the top spot. Meanwhile, Preston started his day in agony. He damaged the car in warm-ups and had to do a complete rebuild away from the track. He missed rounds four and five. Davis and David Campbell bettered their times in round four as did Cochran and Leinbach.

No one moved up in round five. The track was hot; how hot was it? We had reports of 150+ degrees in front of the pit lane. The cars were simply loose and hard to handle.

If round five was uneventful, round six was like the ground attack of Desert Storm. Swauger came out swinging. While running at a pace well ahead of TQ, Swauger looked as if he were on a mission. With less than 2 minutes to go, he tangled with another car. His hopes for TQ vanished—not! Swauger threw the car into warp speed and finished with a 15/5:19.33 for a new TQ time. Also in this excellent round, we saw Skip Starkey and Warren Ophieim move into the top 10.

The 2WD boys would not be outdone. Davis came along and upstaged Husting and Preston. He turned in a very impressive 13/5:02.48 for the new 2WD TQ. Radar speeds on the back straightaway clocked them at more than 56mph. Look out!

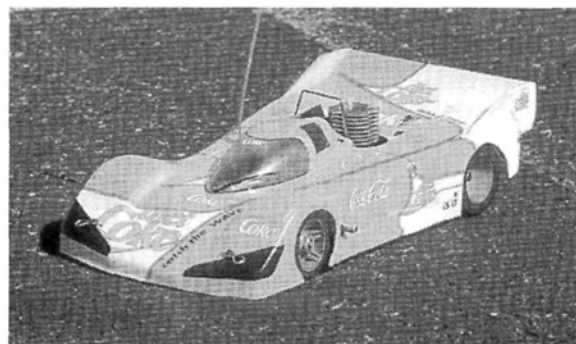
MAINS

The Main events got underway Sunday. The A-Main for the Sportsman—ah, make that Sportsperson—and Pan Classes ran a 50-minute main together. To their credit, seven of the starting eight finished the Main. Sandro Tamburri took top honors in the Pan Class with 105/50:26.37, and Pauline Gottfried won the Sportsperson Class with 94/50:14.67.

The 2WD A-Main saw Husting dominate virtually wire to wire. His P³ (Paris Powered Picco) was on a rail. Preston and Davis tried desperately to mount a challenge. Unfortunately, both had car trouble. Preston's troubles bit him early on and Davis's came later; they waged a back-and-forth battle mid-race, but both drivers eventually yielded to the consistency of Miranda and Cochran. The disappointing fact of the 2WD A-Main was the attrition: only five of the 10 cars finished the race.

The 4WD A-Main was all you could hope for in a main event. Right from the start, it

was a classic duel between Burch and Swauger. The battle would rage between pit stops for the first quarter of the race.



This stunning concours car used a caffeine-free, custom zippered EFRA body.

Burch ran into trouble partway through the race and broke his front suspension. Undaunted, he continued his charge. It was not to be. With less than 10 minutes left in the race, Swauger got around Burch to put him one lap down.

Two bonus battles were fought in the middle of the pack. Sal DiFazio and Tom Ramundo finished only one lap apart in third and fourth. Carbonell and DeSoto finished fifth and sixth, just .3 second apart. Nine of 10 cars finished the Main.

Congratulations to NMRCRCC and to associate sponsors Speedline Racing, Delta, RCM of Miami and Associated/Paris. The 1/8-Scale Nationals was a well-run event. Considering the record number of entries, it was a first-class presentation. This event should set a precedent for the future of gas racing!



2WD A-Main winners.

2WD

FIN	QUAL	NAME	CHASSIS	MOTOR	FUEL	TIRES	RADIO	BODY	SPONSORS
1	2	Curtis Husting	Associated Picco	Paris Picco	O'Donnell	Paris	Airtronics	Elfin	Associated, Paris, Picco, Airtronics, RCPS, L&L, Alpine Motorsports, Alton Air
2	5	Mark Miranda	Associated RC500	Paris Rex	Flamingo	Gomme	Futaba	Elfin	Paris, Advanced Racing Technologies, Associated, Grand Slam R/C Motorsports
3	8	Sean Cochran	Pro-Car Delta P-2	OPS Pro	Blue Thunder	Delta	JR Propo	Parma Lola	Delta, Pro-Car, Hobby Hut, Blue Thunder
4	1	Eric Davis	BMT	Paris Rex	BK	Paris	Futaba	Elfin	
5	3	Davy Preston	BMT Blitz 892	O'Donnell Top	Blue Thunder	Arrows	Futaba	Parma Lola	Speedline Distributing, BMT
6	4	Dave Campbell	Delta P-2	Paris Rex	Delta	Delta	KO Propo	Elfin	Delta
7	9	Brent Gottfried	Delta	Top	Delta	Delta	Airtronics	Elfin	Delta
8	10	Chuck Leinbach	Associated 512	Paris Rex	BK	Arrows	Futaba	Parma Lola	
9	7	B.J. Tannlehill	Delta	Serpent P5	Flamingo	Delta	Airtronics	Parma Lola	Competition Hobbies, Delta
10	6	Josh Alton	BMT	Paris Rex	Snake	Gomme	Airtronics	VDS Lola	Alton Air Racing, Paris, Ace Hardware & Hobbies, Alpine Motorsports

4WD

FIN	QUAL	NAME	CHASSIS	MOTOR	FUEL	TIRES	RADIO	BODY	SPONSORS
1	1	Mike Swauger	Picco Genesis	Paris/Picco	O'Donnell	Gomme	Airtronics	Elfin	Associated, Paris/Picco, Rex, Airtronics
2	2	Ralph Burch Jr.	Picco Genesis	Paris/Picco	O'Donnell	Gomme	Futaba	Elfin	Associated, Paris, Rex, Hyperdrive
3	7	Sal DiFazio	Picco Genesis	Paris Rex	O'Donnell	Gomme	Futaba	Elfin	Associated, Paris
4	4	Tom Ramundo	Serpent	Mega	BK	GTS	KO Propo	Porsche 962	Serpent, RCM of Miami
5	3	Arturo Carbonell	BMT 891	Nova Rossi Top		GTS		Lola	Racer's Choice, BMT, Nova Rossi, Arrows
6	10	Joaquin DeSoto	BMT 891	Nova Rossi Top	Flamingo	Arrows	KO Propo	Lola	RCM of Miami, Acme, Paris
7	8	Warren Ophieim	Serpent	Paris Rex	Delta	Delta	KO Propo	Elfin	Serpent
8	5	Frank Calandra	Serpent XL 9000	Serpent Mega	Flamingo	GTS	JR Propo	Lola T530	RCM of Miami, Serpent, JR Propo
9	6	Robert Ronas	Picco Genesis	Paris Rex	O'Donnell	Gomme	Futaba	Elfin	Associated, Paris
10	9	Skip Starkey	BMT 891	Nova Rossi Top	Blue Thunder	Arrows	KO Propo	Lola T530	Racer's Choice, BMT, Arrows, Nova Rossi

INSIDE JOEL JOHNSON'S

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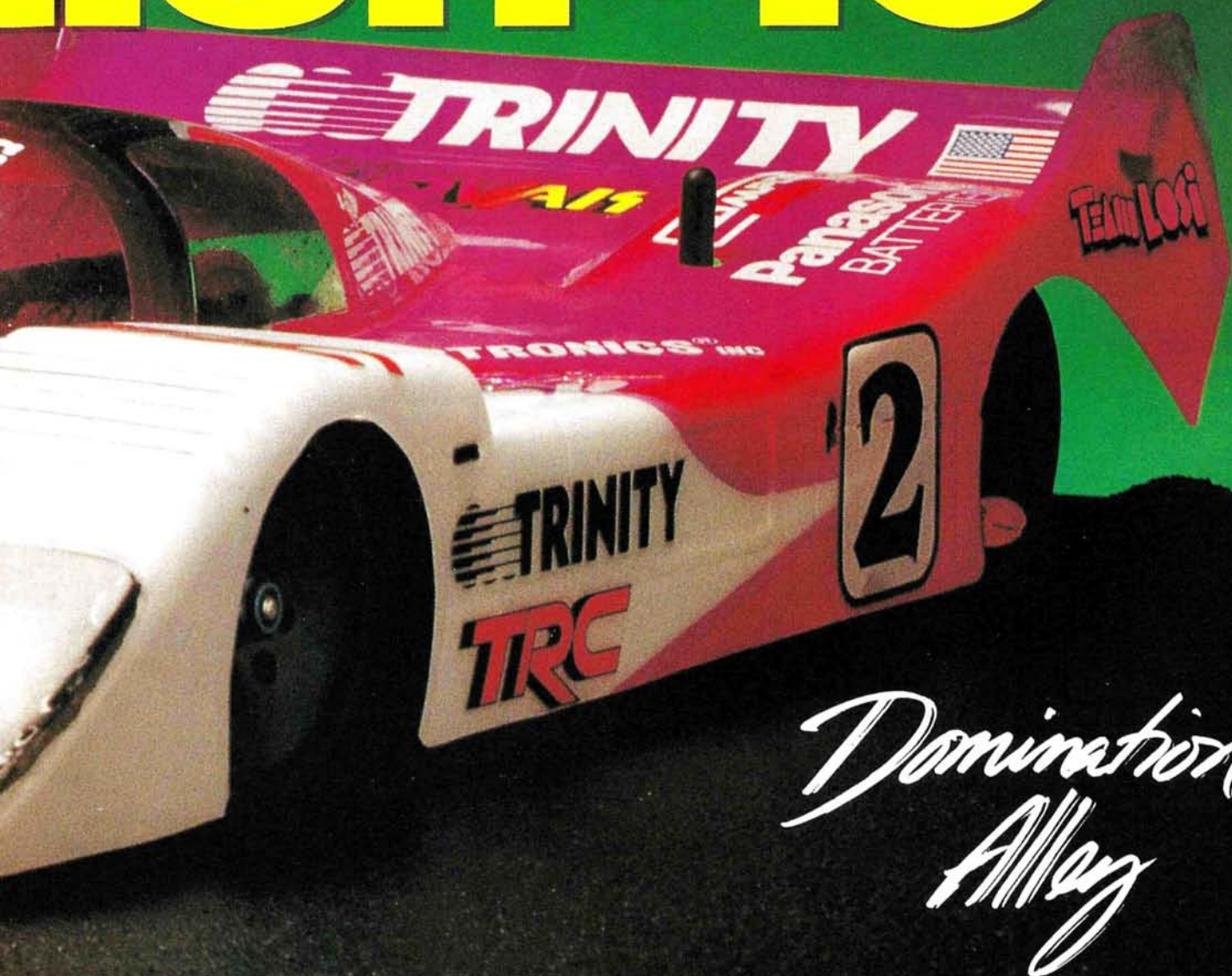
by
FRANK MASI

DON'T THINK it had ever happened—a scratch-built prototype in the hands of arguably the world's best on-road driver, winning the most important $\frac{1}{10}$ scale on-road race of the year.

It's almost like a fairy tale, but that's exactly what happened in

July at the Ranch Pit Shop's road course track. Joel Johnson piloted one of the two existing Trinity* Evolution 10 prototypes to an overwhelming victory at the first IFMAR $\frac{1}{10}$ -Scale On-Road World Championships. Johnson didn't TQ, but from his number two start-

tion 10



Domination Alley

ing position on the grid, he rocketed to a holeshot and never looked back—in not one, not two, but all three of the A-Main legs. This wasn't merely luck. No other driver has won an IFMAR event so convincingly. Johnson's driving talent was a major factor, but the man is

nothing without the machine.

Throughout the event, Johnson's "mystery ride" was kept under towels, away from prying eyes, and when it was time for Johnson to run the car, its designer, Jim Dieter, ushered it to the starting grid; until then, no one outside

of Trinity had seen the car in detail.

Once again, *Car Action* has shattered the secrecy surrounding another hot, prototype car to bring you an intimate look at what may be the next wave in car design—Trinity's Evolution 10.

INNER WORKINGS

• **Chassis.** The basis for Johnson's Evolution 10 prototype is an extremely rigid, yet light, graphite-plate chassis. The chassis is narrow—about 3¾ inches at its widest point—and it serves as a base upon which the car's electronic components and its unique front and rear suspension can be mounted.

The Evolution 10's battery is mounted in-line—a radical departure from the norm. This means that there's less lateral weight transference when the car corners, and this allows quicker directional changes.

• **Front Suspension.** The front suspension is fixed to a graphite plate that's attached to the main chassis plate. This plate also serves as a mount for the Airtronics® 94143 steering servo. The plate sits atop nylon ride-height adjustment blocks, and it's attached to the main chassis with four, long, 5-40 screws and nuts.

The prototype's suspension consists of steering arms with extra-long kingpins that extend down roughly ½ inch, through the graphite suspension plate. The portions of the kingpins that protrude from the bottom of the chassis plate pass through coil springs that are secured to the pins with E-clips. A thick silicone fluid coats the floating king-

pins and provides damping action.

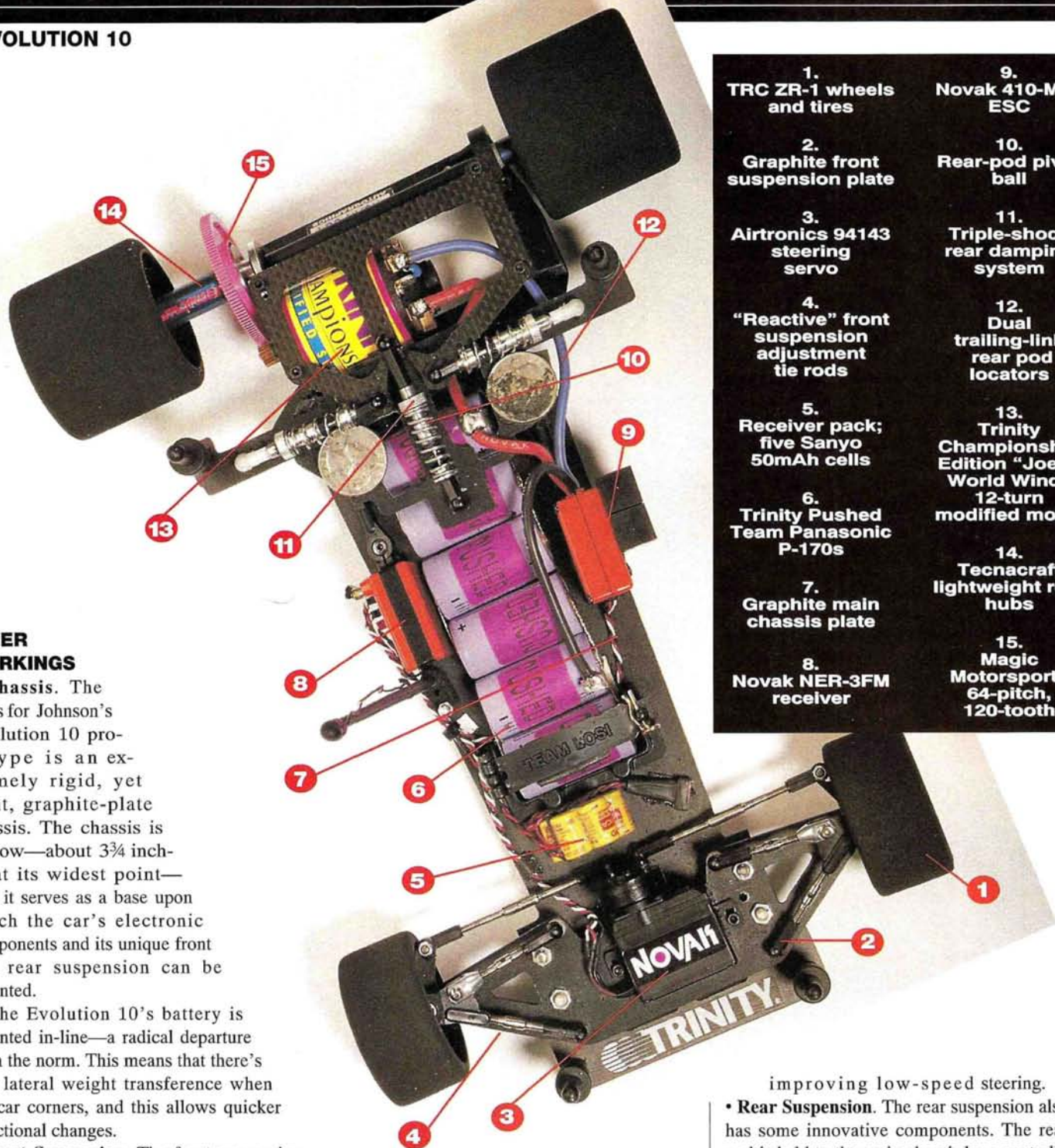
Above the steering arms, the tops of the kingpins are secured with a unique "V" brace that has two, protruding tie rods that extend inward, toward the center of the car, to form an upper A-arm. By altering the lengths of these tie rods, camber can be adjusted. In addition, the angle at which the kingpin pivots when the suspension is compressed can be adjusted. For example, raising the rear tie rod's inner mounting point will make the kingpin lean forward slightly when the suspension is compressed, lessening the amount of caster and

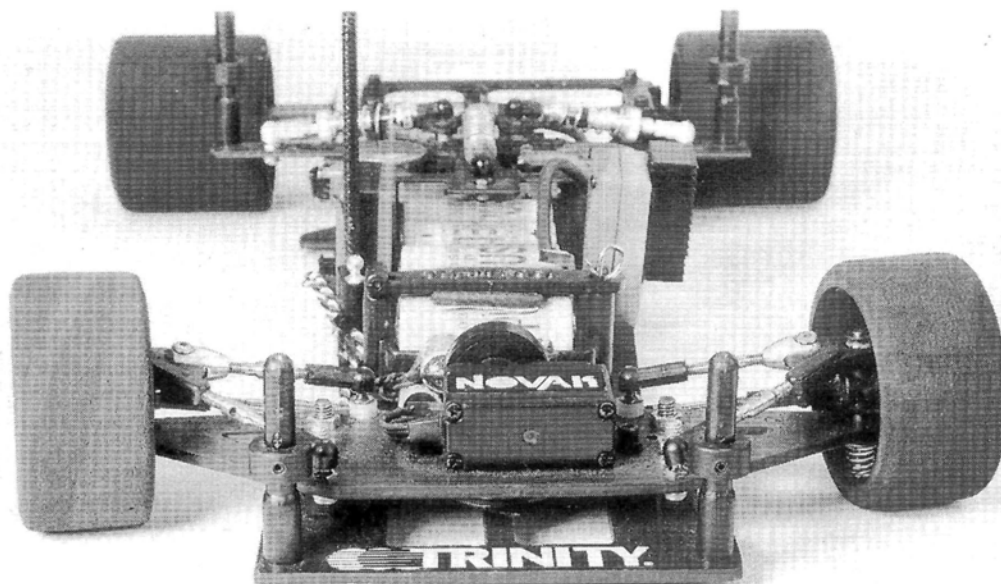
improving low-speed steering.

• **Rear Suspension.** The rear suspension also has some innovative components. The rear pod is held to the main chassis by a centrally located pivot ball. To keep the left and right wheelbases from altering, each side of the pod is secured to the chassis with an adjustable trailing link.

Damping is handled by three Delta-type, oil-filled, coil-over shocks. What's different is that they're mounted in the same plane as the rear pod's upper plate. Mounting the shocks this way means that they'll operate in a linear motion and provide more consistent damping. Adjust the left and right shocks' spring-retaining collars to set tweak. The rear body posts are attached to a graphite plate that's attached to the main chassis with aluminum stand-off posts.

- | | |
|--|---|
| 1. TRC ZR-1 wheels and tires | 9. Novak 410-M1c ESC |
| 2. Graphite front suspension plate | 10. Rear-pod pivot ball |
| 3. Airtronics 94143 steering servo | 11. Triple-shock rear damping system |
| 4. "Reactive" front suspension adjustment tie rods | 12. Dual trailing-link rear pod locators |
| 5. Receiver pack; five Sanyo 50mAh cells | 13. Trinity Championship Edition "Joel's World Wind" 12-turn modified motor |
| 6. Trinity Pushed Team Panasonic P-170s | 14. Tecnacraft lightweight rear hubs |
| 7. Graphite main chassis plate | 15. Magic Motorsports 64-pitch, 120-tooth |
| 8. Novak NER-3FM receiver | |





The Evolution 10's "reactive" front suspension has adjustable camber and caster. Depending on its settings, the front suspension will also decrease caster as it's compressed, and this improves low-speed steering.

The graphite rear axle is mated to a pair of Tecnacraft* super-light aluminum hubs. The differential uses a Magic Motorsports* 64-pitch, 120-tooth spur and pinned diff rings.

• **Electronics.** Johnson's radio is the Airtronics Caliber 3P on 27MHz. It uses a Novak* NER-3FM receiver that's mounted on its end on the car's right side. Directly across from the receiver is a Novak 410-M1 electronic speed controller that's hard-wired to a set of six Trinity Pushed Team Panasonic P-170 cells, which are held in place by a pair of Losi* JRX-Pro battery retainers.

To extend the run time of the Panasonics, Johnson uses a mini-receiver pack made up of five Sanyo* 50mAh cells. This pack bypasses the ESC's voltage regulator and provides a separate power source for the

radio system.

Horsepower for the new World Champion winner comes in the form of a Trinity Championship Edition "Joel's World Wind" modified motor.

• **Tires.** A full set of TRC* ZR-1 wheels with green-compound foam

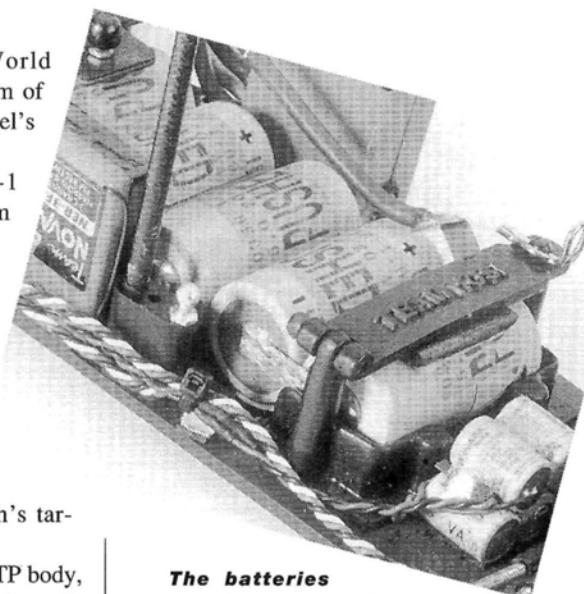
Johnson's victory proves that the R/C racing world can still be "shaken up."

tires, trued to race diameter, kept the Evolution 10 prototype in constant contact with the Ranch's tarmac.

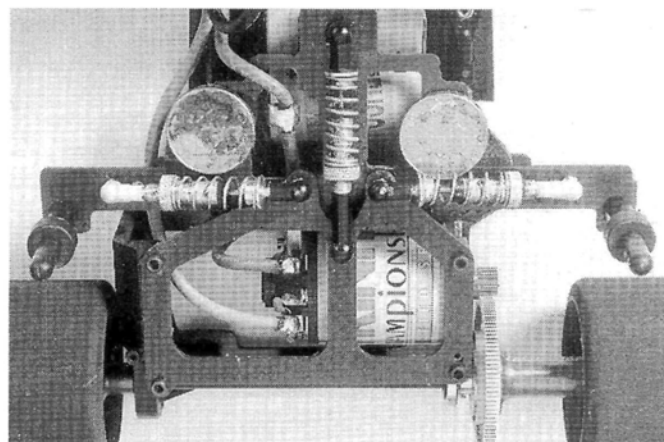
• **Bodywork.** An Andy's* Nissan GTP body, painted in Joel's trademark white and purple paint, tops off Johnson's car. It has many scoops and ducts that were molded into the body to channel the air more efficiently for that extra handling edge. Evidently, it worked!

CONCLUSION

Johnson's victory proves that the R/C racing world can still be "shaken up." Who knows what kind of technical innovations the future may bring? I think that the Evolution 10 is a sign of things to come.



The batteries are placed lengthwise on the chassis, not saddle-pack style as with most other cars. A small, 50mAh cell pack powers the radio.



The rear suspension's triple-shock system provides ultra-precise damping and tweak adjustment. Joel taped four quarters to his car to bring it to the legal weight requirement.

*Here are the addresses of the companies mentioned in this article:

Trinity Products Inc., 1901 E. Linden Ave. #8, Linden, NJ 07036; (908) 862-1705.

Airtronics Inc., 11 Autry, Irvine, CA 92718; (714) 830-8769.

Tecnacraft, 1335B Dayton St., Salinas, CA 93901; (408) 422-7466.

Magic Motorsports; see Trinity.

Novak Electronics Inc., 128-C E. Dyer Rd., Santa Ana, CA 92707; (714) 549-3741.

Team Losi, 13848 Magnolia Ave., Chino, CA 91710; (714) 465-9728.

Sanyo Electric, 200 Riser Rd., Little Ferry, NJ 07643.

TRC, P.O. Box 1058, 2211 Charter St., Albemarle, NC 28002; (704) 982-0507.

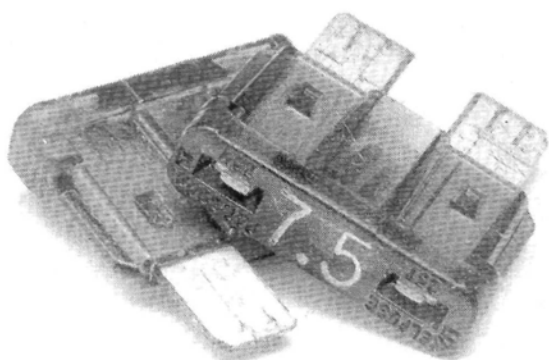
Andy's R/C Products, 1710 Grevalia Ct., Ontario, CA 91761; (714) 923-6155.

RACER



NEWS

SPEED SHOP



TEKIN Fuses

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Price: \$2

Tekin Electronics Inc., 970 Calle Negocio, San Clemente, CA 92672; (714) 498-9518.

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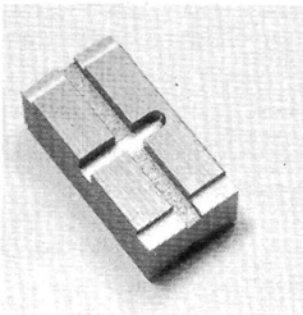
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S&K Racing Products,
215 South Market St.,
Oskaloosa, IA 52577; (515)
673-6930.



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Pro-Line's new tire provides the extra stability of a step-pin with the traction of a mini-pin on harder surfaces.

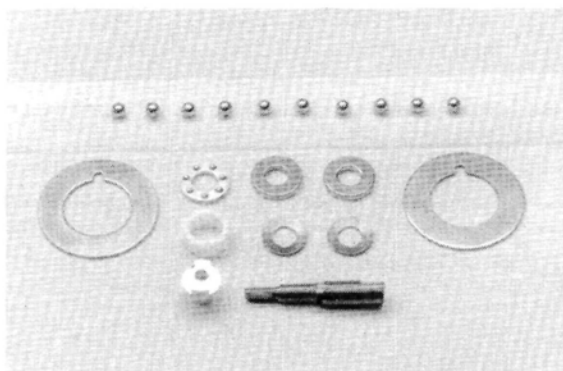
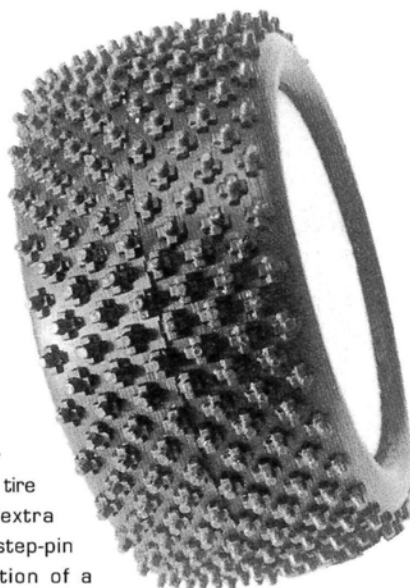
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Part nos. 7110 (XT compound); 8110 (XTR compound).

Price: \$11.95

Pro-Line USA, 201 W. Lincoln St., Banning, CA 92220;
(909) 849-9781; fax (909) 849-2968.



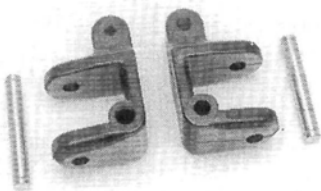
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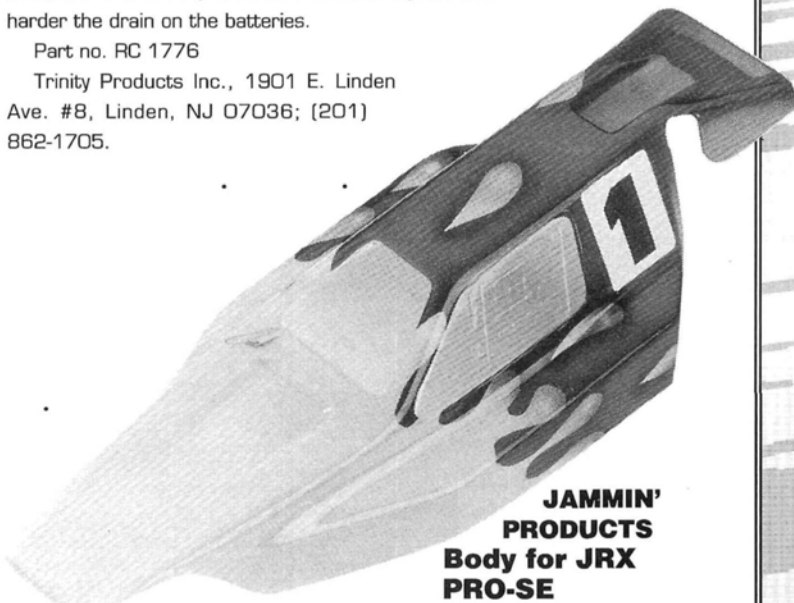
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SUPER SPORT '93

(Continued from page 87)

racing and you're looking for something that's different, try the new Mugen. I guarantee you won't be sorry.

*Here are the addresses of the companies mentioned in this article:

Mugen USA, 7021 Veterans Ave., Brooklyn, NY 11234.
DA Graphite, 1235 Portola Ave., Spring Valley, CA 91977.
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Bru-Line Industries Inc., P.O. Box 3786, Center Line, MI 48015.
Novak Electronics Inc., 128-C E. Dyer Rd., Santa Ana, CA 92707.
Paris Racing, 4254 Independence St., Chino, CA 91710.
TK Designs, 1623 E. Casper, Sandy, UT 84092.

BASICS OF MOTORS

(Continued from page 92)

guessed already, this is called motor (or brush) timing. With everything else equal, stock motors that have 30- or 40-degree timing can theoretically go faster than motors with only 20-degree timing.

Extreme timing works well for stock motors, but can cause high-current modified motors to overheat. It also decreases low-speed torque and acceleration. Always a compromise, choosing the ideal motor is still a demanding task.

(Continued on page 138)

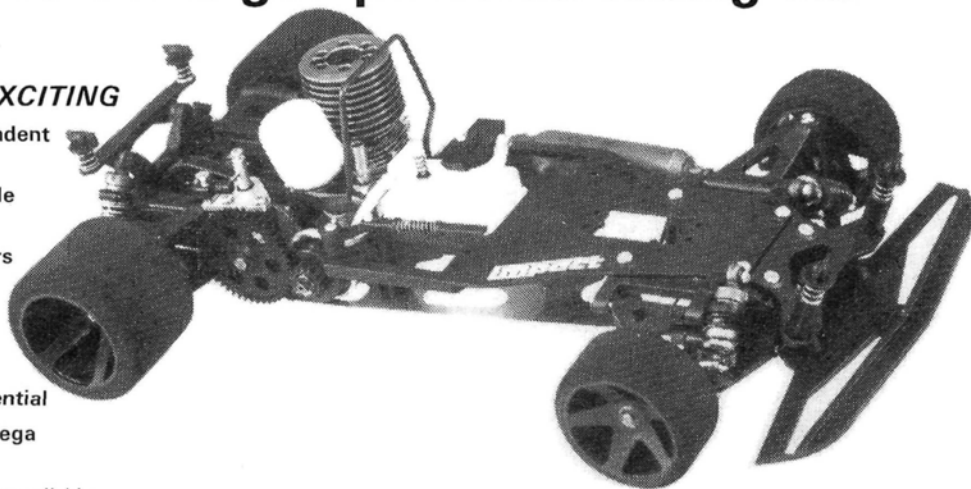
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BASICS OF MOTORS

(Continued from page 126)

This concludes lesson one in basic motor theory. You now know enough to be dangerous. More important, you're now smart enough to annoy your friends with your brilliance and make your parents think you're an Einstein. ■

LETTERS

(Continued from page 9)

the number of times the wire on a motor's armature pole is wrapped around the pole. The length of this wire determines the motor's resistance to applied voltage. Motors with fewer turns will yield more rpm than those with more turns. So how is a 13-turn single different from a 13-turn triple? Although the number of times the wire is wrapped around the armature pole (13 times, in this example) is the same, the number of strands that make up the winding can vary. A single-wind motor has one strand of heavy-gauge wire wrapped 13 times; a triple-wind motor has three strands of smaller-gauge wire, and each strand is wrapped around the armature pole 13 times. The three strands of smaller wire are approxi-

(Continued on page 176)

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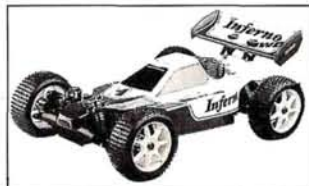
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TROUBLESHOOTING

by FRANK MASI

Motor problems are among life's most baffling—well, to R/Cers, anyway. You know that you can deal with mechanical breakage. Hey, with a little electrical tape, some superglue and a few body clips you can fix almost anything. But when your motor starts boggin', whaddaya do? Read on, and find out!

MONSTER-MOTOR MEGA PULLER

I'm trying to scratch-build a six-wheel, two-motor pulling truck, but I've run into a few problems. Can I run two motors off one speed controller? If not, how can I hook two speed controllers together? Finally, how can I join more than the basic number of cells in an average pack and hook them up?

For regular running, i.e., not pulling, you can run two motors off the same speed controller, and it can be done in two ways. First, the motors can be wired in parallel. For this, you'd have to solder a jumper wire from one motor's positive lead to the positive lead of the other motor (likewise, for the negative terminals). If you use a 7.2V pack, both motors will be supplied with 7.2 volts.

Second, you can connect the motors in series. For this, solder the controller's positive lead to the positive lug on one of the motors, and solder its negative lead to the negative lug on the other motor. Then solder a jumper wire from one motor's open negative terminal to the other motor's open positive lead. With this method, the motors would share the 7.2 volts and be supplied with about 3.6 volts each.

For pulling, it's best to use two controllers. Simply attach one controller to each motor, and then connect the controllers to a Y-harness, which should be available from the radio's manufacturer. Plug the single end of this Y-harness into channel 2 on your receiver. For the batteries, either attach a separate pack to each controller, or attach both speed controllers to one battery.



THE TIMING RUN-AROUND

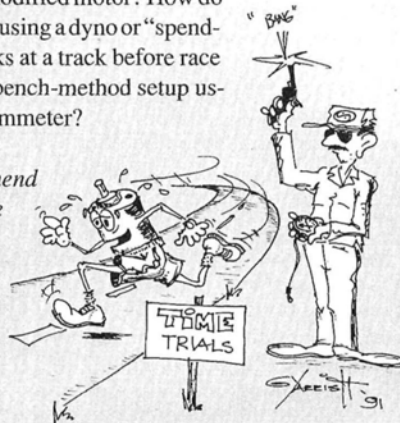
I run an RC10 Graphite racing truck with a Novak MXc, a Stealth tranny and A&L rear trailing arms. For a motor, I use a Losi JR's Choice, a Phantom 19 double (the older style, with the aluminum endbell), or an older, Reedy Gold Dot motor that I bought secondhand.

I understand that the reason for adjustable timing has to do with efficiency, i.e., current versus rpm, and available torque, but when I ask the people at a hobby shop about it, all they do is try to sell me a dyno. Either they're too busy to talk, or they don't know the answers. Why do you alter the timing on a modified motor? How do you do it without using a dyno or "spending" several packs at a track before race time? Is there a bench-method setup using a volt/ohm/ammeter?

I don't recommend that you advance the timing on modified motors. Without going into too much detail, here's an explanation. In a motor

with "zero" timing, the brushes are aligned with the centers of the magnets in the can, and when current passes through the motor, the armature segment is aligned with the centers of the magnets. The motor can take full advantage of the magnets' strength, and though it produces slightly fewer rpm, it runs very efficiently. When current passes through a motor with, say, 45 degrees of timing, the armature segment is positioned 45 degrees beyond the centers of the magnets instead of being aligned with them. Because roughly half of each magnet is rendered useless, the magnetic pull on the armature is reduced, and this allows the motor to rev more. Experienced racers will, however, tell you that no-load rpm doesn't affect performance.

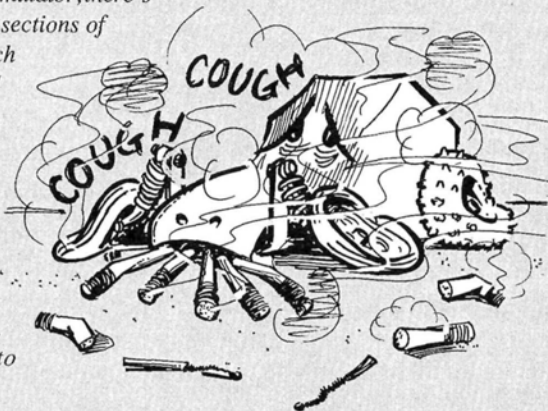
Although a motor with increased timing is advantageous on tracks where racing speeds are very constant, such motors use more current. I prefer to choose the proper motor for the application and set its timing close to zero, e.g., with 1 or 2 degrees of advancement. The motor runs more efficiently in this configuration.



SMOKIN' MOTOR

I love my Team Losi JR-X2. It has a Reedy Competition stock motor, but the motor bushings wore out, and now there's too much play in the armature. The armature rubs the magnets and doesn't produce maximum rpm. I bought a Speedworks Superspeedway motor, which is fantastic. I decided to rewind my Reedy, and at the same time, I took out a few winds. (I had heard of people doing that.) In a way, I succeeded; the motor runs more slowly and smokes like crazy. Why does taking a few winds out do that, and if I rewind it, will it work?

I don't recommend that anyone try to wind or rewind an R/C car motor. Winding a motor isn't just wrapping wire around an armature, and it's best left to the pros. When you take wire off an armature, the insulating varnish cracks. When you re-attach the wire to the commutator, there's a good chance that two sections of bare wire will touch each other and create a dead short. This will cause the wire to heat up and smoke or burn. If your motor's armature is hitting the magnets, it's fair to say that you've had a lot of mileage out of it, and it's about time to buy a new one.



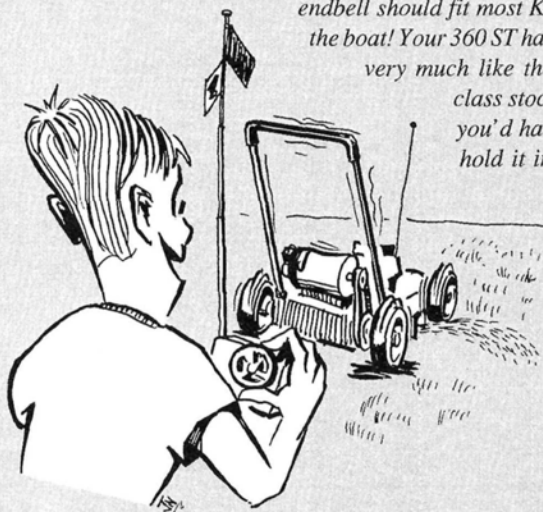
MOWIN' FOR MOTORS

My truck has a LeMans 360 ST motor, for which I recently bought bearings. I want to buy a new endbell for it, too, but my LeMans is a 550-size motor and I've only seen 540-size modified endbells. Would it matter if I used a 540 endbell? If not, what should I use? I was told that modified motors have screws instead of tabs. If I use an endbell, will I have to buy a new can and, if so, which should I get? A guy at my track said I should just buy a new motor, but he has big bucks. Can you help me?

The 550 motors resemble most of the 540 motors in every way except for their length. The 550 motors have longer armatures and, hence, longer cans. A Trinity endbell should fit most Kyosho motors, but hold the boat! Your 360 ST has a sealed endbell that's very much like the endbells on the 540-

class stock motors. To remove it, you'd have to bend the tabs that hold it in place, and this might damage the motor.

Even if you did manage to get the endbell off cleanly, you'd have no way to attach the modified one. Instead of modifying your current motor, buy a budget modified motor. ■



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LETTERS

(Continued from page 138)

mately as thick as the single larger strand, but because the three smaller strands have more actual surface area through which the voltage can pass, resistance is slightly less. This difference in resistance is the reason that a single-wind motor seems to have more bottom end than a triple, but the triple seems to have more top end. A single-wind motor is usually lighter than a multiple-wind motor, and it spins a little more quickly initially. A multiple-wind motor will "spool up" more slowly, but its higher rotating mass can increase the flywheel effect to help maintain higher rpm."

1/4-SCALE SEARCH

I want to get a 1/4-scale off-road truck or buggy. I called all the hobby shops in my area for information, but all I could find was the Raco Jac Rabbit. Could you give me a few suggestions on what to get?

PAUL KILEDJIAN
Glendale, CA

As far as we know, Paul, the only company that makes 1/4-scale off-road cars is Raco Modelcraft Inc. Contact them at 1840 S. Santa Fe #A, Santa Ana, CA 92705; (714) 546-3045; fax (714) 850-1435. LA

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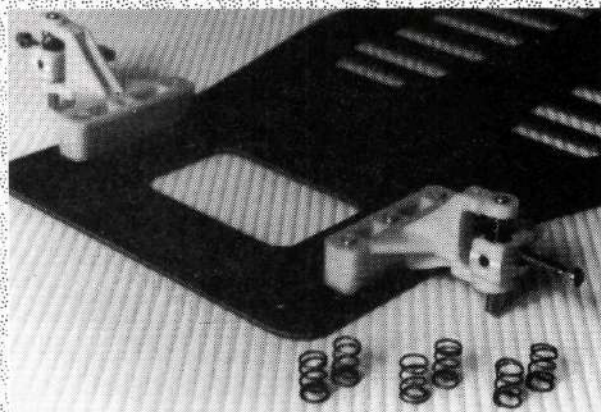
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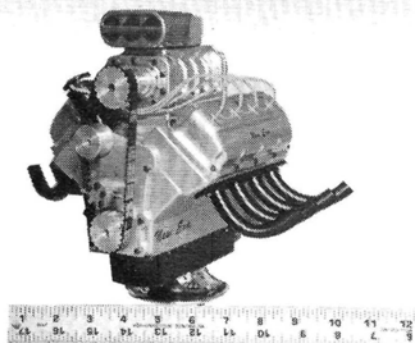
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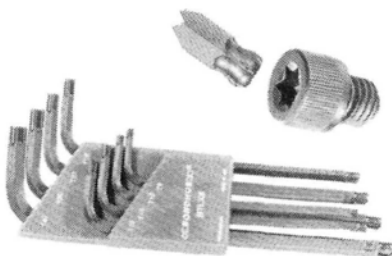
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Bondhus Corp., 1400 East Broadway, Monticello, MN 55362; (800) 328-8310; fax (612) 295-4440.



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Splined setscrews and wrenches are new additions to Holeshot's hardware line. The setscrews are designed to give more torque. It's available in 4-40 or 5-40 (Losi pinion) sizes. To reduce the weight of your R/C car, try the aluminum slotted 4-40x3/8-inch flat-head screws, the aluminum 4-40x1/2-inch round-head slotted screws, or the aluminum 4-40 nuts and washers.

Prices: \$2 to \$4.50

Holeshot Racing Products, P.O. Box 630, Canton, MA 02021; (508) 587-0663; fax (508) 746-7243.



VANTAGE ENGINEERING Motor Dynamometer

The Digi-Dyno tests both stock and modified motors at loads up to 30 amps and with test voltages that simulate actual track conditions. The Digi-Dyno reads volts, amps, rpm, maximum power output and power in watts (the electrical equivalent of horsepower). Its load can be varied from 0 to 30 amps, and you can monitor its power output and rpm under any load. The Digi-Dyno is compact and portable in a rugged aluminum case.

Vantage Engineering, 681 Main St., Waltham, MA 02154; (617) 894-8694; fax (617) 893-4146.



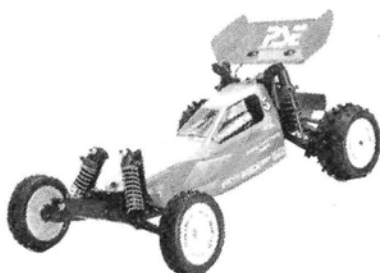
HORIZON

Dynamite's Magnum Force

Here's a powerful new motor cleaner that's priced right. Available in a 16-ounce spray can, Magnum Force is a trichloroethylene synthetic solvent. This potent performer flushes dirt and grime away from electric motors, bearings, shocks and gears and then evaporates instantly, leaving surfaces 99.99 percent free of residue.

Price: \$5.75

Horizon Hobby Distributors, P.O. Box 6029, Champaign, IL 61821; (800) 535-5551.



PARMA/PSE Impulse

A perfect fit, a low profile and a free wing are a few of the benefits that have been designed into this new race winner. Put aerodynamics and the tight fit of an off-road body that's designed to fit the Losi Pro SE to work for you.

Part no. 99004

Price \$15

Parma/PSE Intl., 13927 Progress Pkwy., North Royalton, OH 44133; (216) 237-8650.



DAHM'S Commando XL8™

Dahm's super-narrow, aerodynamic, 1/8-scale fastback Lexan racing-truck body, the Commando XL8, can be painted to look like a Toyota, Chevy, Ford, Jeep, Dodge, or, as shown here on the Kyosho Inferno, a Nissan truck. It fits most 1/8-scale, gas-powered off-road buggies. It has a large hood scoop, roll bars, rear tarps, an escape hatch, an extra-long cab with two extra side windows, decals, number plates, an optional spoiler, molded-in trim lines and finishing and mounting instructions.

Part no. D057

Price: \$22.98

Dahm's Racing Bodies, P.O. Box 360, Cotati, CA 94931; (707) 792-1316; fax (707) 792-0137.



BOLINK SuperPro Springs

These springs are the same size as Bolink's old Pro springs, but they come in seven strengths. They're made of a new, more durable material, so they won't collapse and they'll last longer.

Part nos. BL-5142-A (full set/7 pairs); BL-5142-O (orange/1 pair); BL-5142-B (blue/1 pair); BL-5142-W (white/1 pair); BL-5142-R (red/1 pair); BL-5142-G (green/1 pair); BL-5142-P (purple/1 pair); BL-5142K (black/1 pair).

Prices: \$11/7 pairs; \$2/1 pair.

Bolink R/C Cars, Inc., 420 Hosea Rd., Lawrenceville, GA 30245; (404) 963-0252; fax (404) 963-7334.



TRINITY

Brush Hood Alignment Bar

This new tool helps you to ensure that your motor's brush hoods are in line. It has a purple-anodized handle, and it's machined for a precise fit. Slip this tool through both hoods as you put on the brushes; when you tighten the brush screws, the tool prevents the hoods from moving out of alignment.

Part no. 7913

Price: \$10.99

Trinity Products Inc., 1901 E. Linden Ave. #8, Linden, NJ 07036; (908) 862-1705; fax (908) 862-6875.

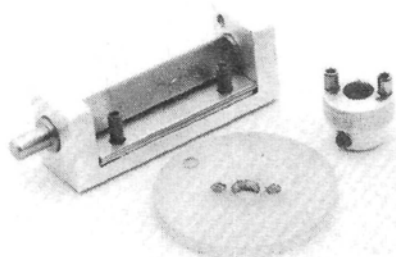


BUD'S RACING PRODUCTS U-Mag Series

These 4.9 wet-magnet, precision-hand-wound, hand-assembled modified racing motors are winning races from coast to coast! Bud Bartos used the U-Mag Series 12-turn double oval to win the 1991 Thunderdrome race. It's a versatile wind that works on almost all speedway ovals.

Part no. 7370

Bud's Racing Products, 1575 Lowell St., Elyria, OH 44035; (216) 284-0270.



THORP Brake for Rampage 1/10-Scale Gas

For more braking power and smoother stopping, attach the disk brake to the jackshaft and the calipers to the chassis. What's more, this brake system won't bind.

Part no. 6060

Price: \$40

Thorp Mfg. Inc., 4054 East Mission Blvd., Pomona, CA 91766; (714) 622-6518; fax (714) 622-2947.

Descriptions of new products appearing on these pages were derived from press releases supplied by the manufacturers and/or their advertising agencies. The information given here doesn't constitute endorsement by *Radio Control Car Action*, nor guarantee product performance or safety. When writing to the manufacturer about any product described here, be sure to say you read about it in *Radio Control Car Action*.

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#6000 CLOD DIFF
Adjustable ball diff will help you power through turns.

#4760 STEALTH
64 Pitch Gear Set

#5310 TRAXAS
Hub and Axle Set. Fits Blue Eagle, Hawk, Sledgehammer.

#4766 Associated /Stealth THRUST WASHERS
For slipper clutch. Twice the ball surface for smooth action.

#5311 TRX-1 GEAR SET
All machined gears. Gear ratio 2.25

#4765 STEALTH
64 pitch hard anodized aluminum top gear and shaft (for use with 64 pitch diff and idle gears only).

#4980 KING CAB
Converts 32 pitch to 48 pitch (for use with Thorp Diff only)

#5112 JRX2/T
Wide 48 Pitch outrdrive gears.

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